"TESTING THE STRENGTH OF CEDAR POLES" IN THIS NUMBER

TELEPHONE ENGINEER

Vol. VI CHICAGO, NOVEMBER, 1911 No. 5

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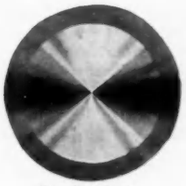

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"Weld-Clad"

Here beginneth the second lesson.

The *Copper Clad Catechism* is continued on advertising pages 4 and 5.

Duplex Metals Company

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CHESTER, PENNSYLVANIA

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NEW YORK

Monadnock Block
CHICAGO

In the A. E. R. Engineering Association question box at the Atlantic City Convention, 1911, question No. 1 was this:

"Is the life of a pole prolonged sufficiently by applying brush treatment to lower 7 or 8 ft. to warrant cost of such treatment?"

Nine railway officials replied and seven answered "yes." The two who replied in the negative did not state whether or not they had tried it. Had they done so, using an efficient preservative, their answer would unquestionably have been "yes."

"C-A-WOOD-PRESERVER"

Can also be applied by pouring it over the poles as well as dipping the poles. Over a hundred thousand gallons have been used by one concern on poles because it pays.

"C-A-WOOD-PRESERVER" also preserves cross arms.

Additional information and reports on tests in our catalog, which is furnished gratis. Write for detail information.

C-A-WOOD-PRESERVER CO.

Wright Bldg., ST. LOUIS, MO.

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TRADE MARK CA WOOD PRESERVER REGISTERED U.S. PATENT OFFICE

WESTERN ELECTRIC COMPANY, Pacific Coast Selling Agents

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YOUR NEW TELEPHONE SUPPLY POINT

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EUREKA Fiber Insulators and Fiber Battery Boxes

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Neat — Convenient — Economical

Approved by leading Engineers.

Free Samples and Specimen Card showing four most popular types of Nails, sent on request.

EUREKA SUPPLY CO.

132 Federal Street, - - - - - CAMDEN, N. J.

Telephone Engineer

WITH WHICH IS CONSOLIDATED THE WESTERN TELEPHONE JOURNAL
ESTABLISHED 1902

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NOTICE TO SUBSCRIBERS

REMITTANCES—Remittances should be made by check, New York draft or money order, in favor of Telephone Engineer. Foreign subscriptions may be remitted direct by International Postal Money Order, or sent to our London office.

CHANGE OF ADDRESS—The old address should be given as well as the new, and notice should be received two weeks in advance of the desired change.

CLUB RATE—In acknowledgment of assistance rendered by subscribers in securing of new orders, a club rate of $1.50 per annum is quoted. This rate applies to new subscriptions in clubs of two or more.

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The Spirit of the Switchboard.

Telephone Engineer

WITH WHICH IS CONSOLIDATED THE WESTERN TELEPHONE JOURNAL
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"PLEASE."

PROBABLY over eighty per cent of manual exchanges have a rule requiring their operators to affix the word "please" to their inquiry for a number wanted. The general idea is that the subscriber is mollified and put in a good humor by the word, which is supposed to indicate an active desire to gratify his wishes.

Occasionally we hear that the operators in a certain exchange have been instructed to omit the polite suffix for reasons of time economy. But as often the opposite is announced. In Detroit, for example, the operators of one of the systems have been saying "Number, please?" only since the middle of August. Before that it was just "Number?" The explanation in the Detroit case is not that the subscriber demands the supposed courtesy, but that the word *number* alone is too short for accurate enunciation.

As a word, *please* is a great deal more distinct and forceful than *number*. The latter is too much like *mumble* when said rapidly. In fact, when the two are combined, the first almost loses its identity in most cases, and the phrase becomes "Nmrpleez?" So, no doubt that argument for the use of the suffix has sound foundation.

But some part of the responsibility for slurring the word *number* in this combination surely rests upon its more forceful latter syllable, which literally usurps and perverts the proper intonation of the phrase. *Number* is the important thing; *please* merely modifies the demand and makes it a request. It is a good deal easier to enunciate *number* correctly without the *please* than it is with it.

When the subscriber lifts his receiver he is prepared to speak the number he wants as soon as the operator indicates her presence. That being the case, almost any sort of sound might suffice to show the subscriber she was listening; and as a sound, probably *nmrpleez* is as good as any. But is the indication of attention the sole function of the operator in ascertaining the number to be called?

The operator's method of asking for a number must serve two purposes. Primarily it must cause the subscriber automatically to utter the number clearly and promptly without distracting him by any doubt as to just what she said. Secondarily it must be courteous and pleasant enough to imbue him unconsciously with an impression of ready and willing service. Whatever term best fulfills these conditions is the one to use.

When the word *number* is enunciated clearly, with just the suggestion of a pause on the *m* and a rising inflection on the *ber*, and moreover in a voice of trained pleasantness, it has psychologically just as wholesome an effect as can be obtained by the use of *please*. The word *number*, indeed, is more expressive if less forceful than the word *please*.

If the comparison were between the word *number*, enunciated as suggested, and the same word with the *please* affixed, the latter might be preferable. But we seldom have that choice. If *please* is added *number* suffers. Indeed, an operator handling some two hundred and fifty calls per hour does not have time for three distinct syllables with their proper inflections. Our choice is between *numm-ber*, with the rising inflection, and *nmrpleez* without any inflection. As to time, one has little or no advantage over the other; but one is a complete, distinct word, and the other is but a sound. Properly spoken, the word is preferable to the sound.

Speaking of operating methods in Detroit, the company that was mentioned as recently adopting the suffix has put another order into effect which is of greater merit. When the operator cuts in on a line she merely says "operator." In ordinary practice she says, "Have they answered?" when she knows they have not. The word "operator" is far better. It indicates the willing servant, ready to take the next order, whatever it be. In this case the company has not required her to add *please, thank you,* or *your humble servant.*

CORPORATE PUBLIC RELATIONS.

RELATIONS between the public utility and the public it serves have become of vital import only within the last few years. It is only lately, indeed, that public service corporations in general have regarded themselves as amenable to the dictates of the public. They have made wonderful progress, however, and to day it is not unusual to find the public actually abetting an increase of rates or an adjustment of unfair competition.

The subject indicated in the head of this editorial was discussed at some length by H. O. Seymour, who is general agent for public relations for the Chicago Telephone Company, at a meeting of the Chicago Electric Club. The following abstract of Mr. Seymour's talk indicates his view of public relations:

> The time has come when it is no longer fashionable or typical of the true situation for the public to be antagonistic to public utilities.
>
> Utilities seek a friendly relationship with the public. In the near future this relationship will be established and largely through the utilities themselves and the utility commissions of the different states. The public at the present time cannot master the details of these immense enterprises. Eventually it will and then the utility and the public will be as buyer and seller.
>
> The public now thinks of the utility as master and itself the servant. The utility depending on the public for life thinks itself the servant and the public the master. This will be changed. We will be the sellers and will ask fair patronage. The public will be the buyer and ask good service for its money.

When the first street car was started the public stood aside in applause. It did not care how much the street car brought in profits. It only wanted the car. The same way with the telephone and the electric light. But now that the enterprises have developed to large proportions and it is impossible for the public to conceive the intricate details of the business it becomes suspicious and cries, "excessive returns," "watered stock" and "corruption."

The speaker went on to show whence came the common suspicion of watered stock. Almost always it has arisen from a misunderstanding of going value—failure to grasp the fact that early promotional expenses and the cost of getting the first business, before there were any profits, must necessarily be capitalized. When a public service plant is appraised, its operating expenses ascertained, and its rates adjusted on those bases to render a supposedly equitable return to investors, the corporation has been wronged.

The people are beginning to understand a little about depreciation; which is encouraging, for only a few years ago not very many corporation managers knew anything about it. The matter of going value may be a little more difficult. The layman is familiar with wear and tear in his own experience; but only a minority of his number realize the fact that it takes money to overcome the inertia of a new business.

As Mr. Seymour suggests, the state utility commission affords the only really hopeful solution of the problem of educating the public. Even with the commissions it will not be a matter of showing the people so much as deciding for them. And the people will sometimes doubt the sincerity of their commissions, just as they now sometimes doubt the sincerity of their courts, their public officials and their representatives.

But the mere doubt, so long as it is unfounded, can do little harm. With a judicious appointment of commissioners both the utility and the public will be on safe ground, and their harmonious relation will become automatic.

ENGINEERING AND LOADED LINES.

ELECTRICAL engineers engaged on complex transmission and power problems have not been much inclined to regard telephone engineering as an exact science. Until recently no doubt there was some reason for their lack of respect for the calculations of voice-current effects. Even in the larger systems and on long distance lines telephone engineering was largely a cut-and-try proposition. The results achieved were wonderful from the beginning; but they were due to the genius of the inventor more than to the wisdom of the engineer.

But the attitude of the electrical engineer toward his brother of the voice current is changing. No better evidence of that is needed than the interest in telephone subjects lately evinced by the American Institute of Electrical Engineers. The remarkable series of telephone papers read before that body during the present year, most of which have been or will be published in Telephone Engineer, and the way those papers were received, bear ample testimony to the new position of the telephone engineer in technicaly circles.

One of the papers mentioned was that on "The Loading of Long Distance Lines," by Bancroft Gherardi, the last intallment of which appears in this issue. We refer to this treatise particularly because line loading is, in our opinion, the responsible factor in the elevation of telephone engineering. We quote below the contribution of E. H. Colpitts to the lively discussion which followed the reading of Mr. Gherardi's paper before the American Institute:

I wish to call attention to one or two features connected with loading; that is, the necessary engineering studies and scientific investigation in connection with the application of loading are making telephony, from the standpoint of line transmission, an exact art.

Ten years ago when the rule for loading was first given us by Professor Pupin, the only method of determining whether a certain piece of apparatus introduced into the telephone line would cause a transmission loss or a transmission gain, was to actually make a transmission talking test over the circuit. When the art of loading was introduced it was recognized that much more refined methods of measuring the electrical constants of telephone apparatus and telephone lines under the electrical and magnetic conditions of telephone service must be developed. It was seen that actual telephone currents could not be employed, but that it would be necessary to employ alternating currents of telephonic frequencies and amplitudes. At that time no high frequency generators had been designed which would satisfactorily deliver the necessary high frequency currents. Therefore, one of the first problems the telephone engineer had to undertake was to design high frequency generators capable of delivering alternating currents at frequencies of from 200 to 3,000 periods per second. In order to employ this current in the methods which seemed most practical and desirable it was necessary that the open circuit electromotive force of these generators should be as nearly as possible free from harmonics. Such generators were designed.

Among the problems of a physical nature which confronted the telephone engineer it was necessary to device methods of measuring accurately the losses in iron and its various alloys when subjected to magnetizing forces as small as 0.005 c.g.s. units and when fluctuating corresponding to alternating currents at frequencies of from 200 to 3,000 periods per second. The telephone engineer today is able to measure such losses with a high degree of accuracy. The engineer had to devise methods of measuring losses in dielectrics at the telephone frequencies which I have mentioned and at the low potentials which are involved in actual telephone transmission.

In addition to this, methods of measuring very accurately the inductance and effective resistance of loading coils were developed. The measurement of inductance accurately in terms of inductance standards is not at all difficult, but the measurement of effective resistance with a small current and at a high frequency requires most carefully designed apparatus and a complete knowledge of all the factors involved, many of which factors it would seem at first sight to the ordinary engineer could be neglected.

In connection with loaded lines themselves, as Dr. Jewett has already indicated, we soon found that we had to take account of facts which had hitherto been neglected. As an instance, it became evident that we had to measure accurately and consider the effect of bridged impedances on the efficiency of loaded circuits; whereas, in case of unloaded circuits the effects of such bridges could very generally be neglected. Also, in the design of cables which are to be loaded it is very important that electrical symmetry or balance be preserved, and the engineer is interested in capacities and differences of capacities as small as one-millionth of a microfarad in lengths of 400 or 500 feet of cable. He can today measure and take account of these small differences in capacities between the wires of one pair and the adjacent pairs.

So far I have referred merely to measurements upon the elements used in loading. A large amount of work has been done in connection with the development of methods of making measurements upon telephone circuits, in order to determine the various terms involved in their transmission efficiency. I mention these merely as illustrations of the general nature of the development work necessary to the present conditions of the loading art.

When we realize that today there is in successful operation a telephone line from New York City to Denver, Colo., and that a talking connection with San Francisco is promised New York by the engineers who designed the Denver line, we begin to appre-

ciate the real engineering work done by the modern telephone engineer.

Dr. Pupin's loading system was an invention, it is true, but it was an engineering invention in the truest sense of the word. It was not genius, but mathematics, that designed the Pupin system; and it needs real engineers to apply it.

There are other factors in modern telpehone engineering that perhaps are entitled to as much credit as the loading of lines. But the loading system is representative of the new order, and the new order means that the telephone engineer stands today the equal of his confreres in any line of technical endeavor.

HOW TO USE THE TELEPHONE.

COURTESY between users of the telephone has received a great deal of attention since TELEPHONE ENGINEER conducted its prize contest for essays on that subject and published the winning essays in the winter of 1909-10. We do not mean to imply that courtesy was unknown before we tackled the subject; nor do we insist upon recognition as the responsible factor in the present rather satisfactory state of telephonic etiquette. We do believe, however, that the rather remarkable series of articles we published, and the extraordinary amount of publicity which they subsequently received, have had a great deal of influence upon the gradually changing ways of the telephoning public.

The majority of telephone calls of this country are of a business nature. And the majority of those business calls are conducted, or at least started, by employees. With this condition in mind the solution of the problem of telephone civility becomes obvious. It but remains for the employers to instruct their employees in the proper and courteous use of the telephone, and to insist on their observance of such rules, and telephoning becomes at once a delight and a joy.

The encouraging thing is that most of the larger corporations have already so instructed their employees. So even now we have a majority of business calls made by employees, and a majority of employees instructed to be courteous. While three majorities may very easily make a minority, we must not forget to include those who are naturally courteous—not an inconsiderable number by any means. So, we repeat, the situation is encouraging.

Rules for employees' use of the telephone may be brief or the contrary. Some of the short and concise sets of rules are very good; but for covering the subject thoroughly, we have seen nothing superior to the pamphlet issued by the Commonwealth Edison Company of Chicago, to its employees:

PROMPTNESS.

When your telephone rings, answer it promptly; when an employee is away from his desk and his telephone bell rings, the nearest employee should answer it at once. Telephone etiquette *begins* with a prompt response.

HOW TO ANSWER.

The lack of an explicit and uniform method of answering telephone calls is responsible for much waste of time. Such responses as "Hello," "What is it, please?" etc., should be avoided; the first expression is meaningless, while the second, though courteous, is inefficient and only results in prolonging the conversation, as the person making the call is usually obliged to enquire the name of the respondent. While it is not practicable to formulate phrases that will meet with every condition, the following responses may be generally employed:

(1) Where an employee answers the call, and his personal identity is not of special importance, the name of the department or office should be given, as for example. "Contract Department," "Treasurer's Office," "Repair Department."

(2) Where the employee, in a sense, answers for the department, and at the same time has direct dealings with the public, and the line on which he answers is more or less individual, he should give the name of his department, followed by his own name, thus: "Contract Department, Mr. Brown."

(3) Where the line is individual, and is not used by the public to any extent, the name only should be given in responding, as: "Mr. Smith," "Mr. Jones." This should also apply in all cases where a call has been answered by one person, and request has been made for another; where this is known, the second person should answer with his own name.

(4) Employees taking calls over lines located in the private offices of officials, or department heads, should answer as follows: "Mr. Gulick's office." "Mr. Fowler's office." Where a name is given in answering a call, it is always more dignified and courteous to preface the name with "Mr." or "Miss," as the case may be.

(5) Endeavor to obtain, as early in the conversation as possbile, the customer's name, address and telephone number. Failure to do so frequently results in considerable delay and annoyance to the customer, as it is not at all an uncommon occurrence for a customer to hang up his receiver abruptly, before remembering to supply this necessary information, or to be inadvertently cut off before he is through talking.

BREVITY.

In order to be brief, it is not necessary to be brusque; the sharp, peremptory tone employed by so many people when using the telephone cannot be too severely condemned. In the practice of brevity, it is only necessary to be businesslike and concise. In using the telephone, remember that unnecessary conversation ties up a trunk line on the busiest board in Chicago. If the requisite data is not at hand, do not ask the customer to hold the line, but obtain his telephone number and call him up as soon as you have secured the desired information.

COURTESY.

Courtesy is the outward expression of breeding and character. Its practice is founded upon the Golden Rule of "Doing unto others as you would they should do unto you." In very few industries is the need of courtesy more imperative than in ours; the business of manufacturing and supplying electric light and power is, to the layman, peculiarly technical and mysterious. He does not comprehend its complicated processes, and he resents its apparent mystery. In dealing with this type of man, who cannot understand why his service is not connected within twenty-four hours after signing an application, or why he should have to obtain city inspection on his power installation, our employees have daily opportunities for showing the quality of their courtesy. It is necessary for them to remember that the customer is unacquainted with many conditions with which they are thoroughly familiar, and in imparting this knowledge to the customer, they should do so without any assumption of superiority, or any display of impatience. The favorable impression made upon a customer who takes up his telephone to register a vigorous complaint, and who finds a courteous employee at the other end of the wire quick to understand his difficulties and eager to remedy them, cannot be overestimated. From being one of its severest critics, the customer becomes one of the company's best friends; he is usually gratified to recognize the courtesy with which he has been treated, and does not hesitate to advertise it amongst his friends. True courtesy *pays*:

(1) Because it makes friends for the company, as well as for the employee.

(2) Its practice is conducive to greater dignity and self-respect.

(3) It eliminates friction, and lubricates the machinery of business.

(4) It refutes the traditional attitude, popularly ascribed to public service corporations, of being callously indifferent to the interest of their patrons.

PROMISES.

Only authorized employees should make definite promises for the delivery of goods, or the completion of work on a given date, and these employees should at once make a record of such promises, and hold themselves personally responsible for their fulfillment. If it subsequently develops that the goods cannot

be delivered, or the work completed as agreed, the employes should call up the customer prior to the date promised, and make whatever explanation is proper under the circumstances.

PERSONAL USE OF TELEPHONES.

The company does not desire to unduly restrict its employees in the necessary personal use of its telephones; it should be understood, however, that the abuse of this privilege will not be permitted. The supervisors of the Chicago Telephone Company's various exchanges, and the chief operator of our own switchboard are instructed to report any abuses of this nature which come to their attention.

SWITCHING.

Our customers are often referred to the wrong department, owing to the indefinite nature of their requests, and in this manner are frequently subjected to the annoyance of being switched from one department to another, before they are finally able to tell their story to the right man. The resultant impression made upon the customer is extremely unfavorable, and this practice should be avoided as far as possible. If it is necessary to transfer the person calling, to another department, the operator on our switchboard should be signaled, and asked to secure the desired connection. Whenever it is practicable, our employees are requested to take down the customer's message, and see that it is forwarded to the proper department for attention; they should also offffer to make a note of any messages intended for an employee who is absent, and see that such messages are delivered.

TELEPHONE PEAKS.

The principal peaks on our switchboard occur between the hours of 9:00 and 10:30 a. m., and from 4:00 to 5:00 p. m. In addition to these regular peaks, there is also a heavy traffic on the switchboard at times of abnormal darkness during the day, or following any severe storms, or any serious breakdowns on our lines. Employees are requested to pay due regard to these conditions, and to avoid using the telephone except in the necessary discharge of their duties, during these periods.

Clear, isn't it? No wonder the Commonwealth Edison Company has a good name among those who have occasion to telephone to its various departments. But the rules are not peculiar to the Chicago electric service corporation. They may be presented to the employees of any concern with a practical certainty of beneficial results. And it is not at all likely that the Commonwealth Edison Company would object to their adoption by other employers. If every exchange manager would hand in copy of the rules to each of his business subscribers, with the suggestion that he adopt them as part of the policy of his house, we might almost expect to see the telephone millenium at hand in the course of a year or two.

WHAT IS ADVERTISING?

A SHORT time ago Telephone Engineer published an editorial listing the advantages of a monthly magazine over one issued more often. It cited facts obtained from research work in the advertising output of several hundred trade and national magazines. Therefore, we can start on this basis as fact. A monthly magazine has more time and opportunity to obtain facts, data and material regarding the important events; more time can be devoted to the arrangement and exposition of this subject matter. Subordinate subjects can be boiled down and paragraphed. Leading topics can be more clearly and fully exploited.

Telephone Engineer followed this with an editorial listing the number of possible buyers in the telephone industry. We showed that of 22,971 so-called telephone systems only 5,269 are actual operating telephone companies.

Only 5,269 companies are large enough to be a factor in buying goods from a manufacturer. The balance, 17,702 operating systems, consist of farm or rural telephone plants with an average of less than 100 telephones per company. These little fellows must buy through their local jobber, who, by bunching orders for wire, screws, nails, cleats, etc., is able to make shipment at a profit. No manufacturer could afford to advertise to reach so small a buyer. Where is the manufacturer of wire who can afford to measure off, check, wrap, tag, cart and freight 100 feet of No. 14 duplex? Those orders must go through the jobber. And where is the jobber that would not substitute what he has in stock, to a customer whom years of association has made a believer in the jobber's knowledge of what is good, in preference to ordering a small quantity of goods from some manufacturer whose advertising has induced the little buyer to inquire from his jobber—"Is it good?" So advertising should be directed toward convincing the larger companies and the jobber.

How can one judge the best mediums to effect the greatest amount of *sales* to the discriminating large buyer? By finding out what trade publication he gets and advertising in that, taking space large enough to attract his attention, and using the most direct and forceful sales argument in the copy.

Analyze the trade publications. If a magazine contains text describing new methods of construction, economies in operation, kinds and style of material found valuable in different localities, tables, data and helpful information and a company is making supplies which will appeal to live, up-to-date telephone men, keen on improving their plant, construction or equipment, that company's advertising should be found in that magazine.

Then in considering the foregoing one must also contemplate the cost of advertising. A quarter page in a weekly is equal to a full page in a monthly. When reaching the buyer will an argument attract as much attention in a quarter page as a full page would? All things being equal, the larger the space the more economy. This may seem paradoxical; but it is a fact that one page of advertising looks like more than six quarter pages. Just so does one page of advertising at a given price per month outweigh and be a greater economy than one quarter every week at one-fourth the price, and there is the advantage that a monthly magazine lasts longer than a weekly.

Telephone Engineer points with pride to its advertising pages. The names in our advertiser's index are all those of established, sound business houses. Not that we have all that there are, but that we have none of the other kind. And the advertising list is growing. A year ago Telephone Engineer had 43 advertisers. At this writing it has over 73 with, as they say at election, "Some precincts not in yet." A gain of 58.8/10 per cent in one short year.

This gain—and there will be further gains—proves that a telephone magazine that is not dominated by either faction of the telephone industry, that prints technical and non-technical subject matter of helpful interest to operating telephone men, which forgets politics and mud-throwing partisanship in an earnest, honest attempt to play fair with the entire telephone industry, is desired by the field and affords a worthy advertising medium for the clean and upright manufacturer desirous of reaching the entire field. Advertisers, our hats are off to you.

Testing the Strength of Cedar Poles

By Frank McGill Carson

General View (A) of the Pole Testing Apparatus.

A SERIES of tests were recently made to determine the ultimate unit fiber strength of western cedar and Port Orford cedar poles. A brief outline of the method of conducting the tests and a resume of the conclusions derived were given on page 79 of the August number of TELEPHONE ENGINEER. The additional data recorded here, however, are deemed worthy of presentation in view of the dearth of authoritative literature on the subject.

TIMBER—TEST SPECIMENS.

The values for the ultimate unit fiber stress of the most strained fiber (modulus of rupture), given herein, are applicable only to round cedar poles from the districts designated, of the respective species, and having sapwood. In other words, these values are the moduli of rupture of the round cedar poles as used to build leads in the West.

The test specimens were as near the average "wood run" of round poles as was possible to obtain and were of three classes:

1. Western Red Cedar (*Thuja Plicata*), from Idaho.
2. Western Red Cedar (*Thuja Plicata*), from Oregon and Washington.
3. Port Orford Cedar (*Chamaecyparis Lawsoniana*), from the western slopes of Oregon.

Each class of poles was segregated into three divisions, according to length, 25 foot, 30 foot and 35 foot. Of each length there were nine poles of varying top sizes, as follows:

Number of poles	Top size	Length
3	6 in.	25 ft. and 30 ft.
3	7 in.	
3	8 in.	
3	7 in.	35 ft.
3	8 in.	
3	9 in.	

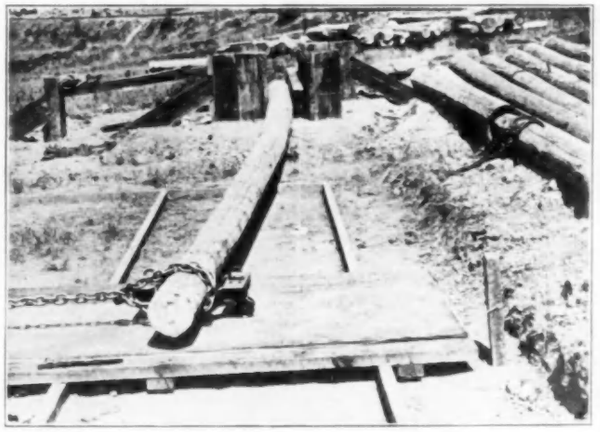
All poles were stripped of bark. The Port Orford cedar poles were seasoned 23 months and had been cut from standing fire killed timber. All poles were summer cut. This wood is, as yet, little used, but would, as soon as its virtues were recognized, become a formidable rival to Western cedar in territories convenient to the source of supply were it not rather limited and inclined to find increasing popularity in fields which bring better prices.

The Western cedar poles were seasoned from one to eight years, and had been cut from growing timber. Of the Western cedar the summer cut predominated.

Curves are given for other pole woods. The redwood poles are generally square in section and sawn to any of the wide range of commercial tapers. Unlike natural poles, sawn poles may have an enconomical taper and provisions for butt rot.

APPARATUS.

The illustrations and sketches give a clear idea of the apparatus used. The original plans, as given for bracing the machine, were altered slightly, due to the soft nature of the soil. The apparatus proved very rigid. Although this apparatus was constructed of Douglas fir,



View (B) of the Testing Arrangement.

this wood is not recommended where butt rot is severe unless thoroughly impregnated with some preservative. The 2 by 2-inch stakes were driven deep into the ground and all measurements were taken from them. See Fig. 2, *A*, *B* and *T*. The platform, over which the end of the pole rides, may be adjusted to accommodate any length of pole, from 18 to 40 feet, by sliding it along the 2x6-inch runners. The double sheave blocks and winch combined gave a mechanical advantage of one hundred and fifty.

METHOD OF CONDUCTING THE TEST.

The conditions of actual service were duplicated as nearly as possible in the apparatus; six feet of the butt of the pole being held rigidly and horizontally between four upright 12x-112-inch Douglas fir posts. See illustrations *A* and *B* and Fig. 3.

The upper part of the pole extended horizontally forward, free from all obstructions. The extreme free end of the pole, just back of the point of load, was supported by a "dolly," equipped with easy running truck castors which, in turn, traveled on sheet iron, thus eliminating gravity from consideration. The constant pull necessary to haul the dolly loaded was ten pounds, the final readings being corrected by this amount.

A direct reading Fairbanks traction dynamometer was placed between the pole and tackle and an initial tension, sufficient to clear it of all obstructions, put in the ropes. The dynamometer was calibrated and a correction curve made, the true readings being plotted against the observed readings.

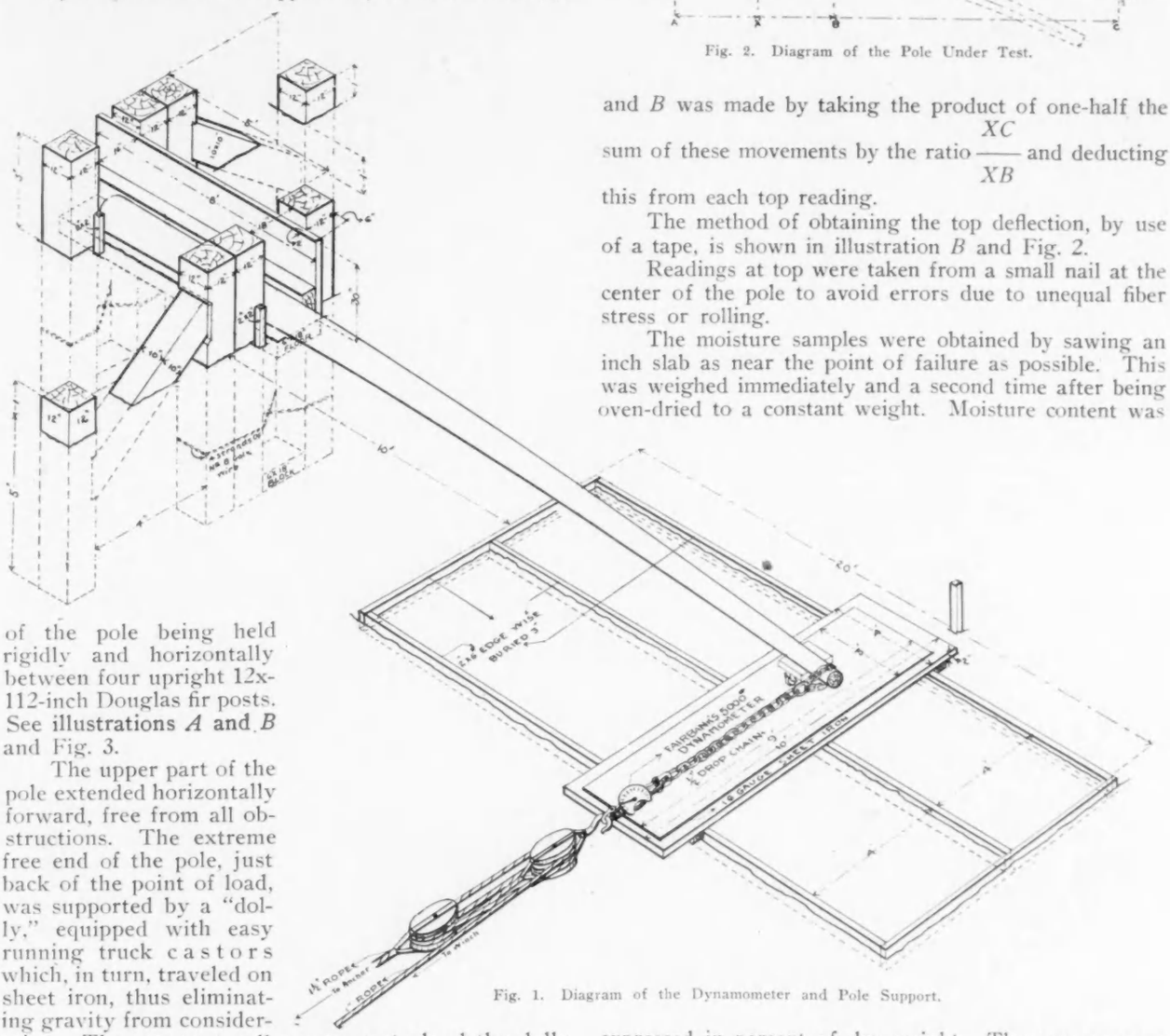


Fig. 1. Diagram of the Dynamometer and Pole Support.

The load was applied then continuously at the rate of one foot per minute until complete failure of the specimen took place. At each increment of one hundred pounds a deflection reading was taken at the top and at the two butt points *A* and *B*, Fig. 2.

An approximate correction for the give at points *A* inating gravity from consideration. The constant pull

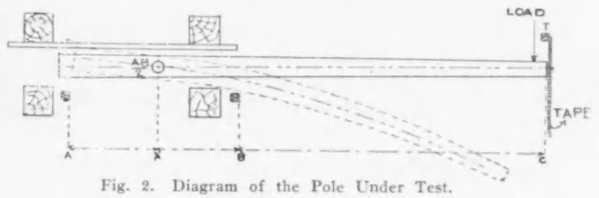


Fig. 2. Diagram of the Pole Under Test.

and *B* was made by taking the product of one-half the sum of these movements by the ratio $\frac{XC}{XB}$ and deducting this from each top reading.

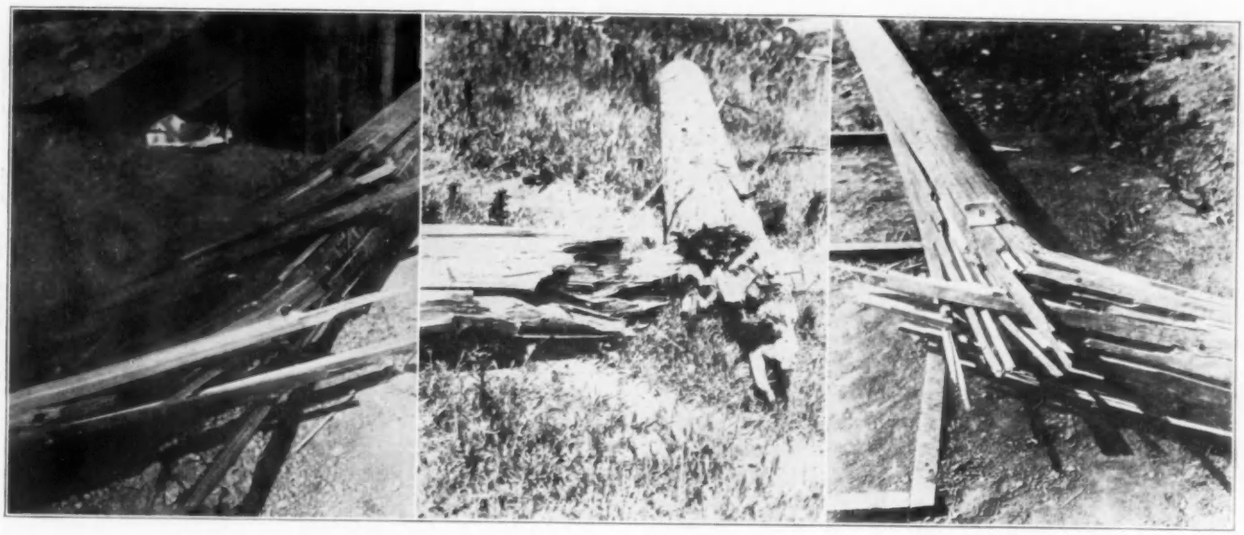
The method of obtaining the top deflection, by use of a tape, is shown in illustration *B* and Fig. 2.

Readings at top were taken from a small nail at the center of the pole to avoid errors due to unequal fiber stress or rolling.

The moisture samples were obtained by sawing an inch slab as near the point of failure as possible. This was weighed immediately and a second time after being oven-dried to a constant weight. Moisture content was expressed in percent of dry weight. These same cross sectional slabes were used to obtain the dimensions of sapwood and heart. The data obtained was as follows:

Any injury to pole from worms, ants, grub, dry rot, toredo, checking (star, ring or weather) or rough handling.

L—Total length in feet,
C_{Top}—Circumference at top in inches,
C—Circumference at ground line (6 ft. mark) in inches,
C_{Butt}—Circumference at butt in inches,



Pole 1. Pole 6. Pole 9.

C_f—Circumference at fracture in inches,
p—Load at each increment of one hundred pounds,
P—Ultimate load or load at failure,
W—Weight of pole in pounds,
V—Volume of pole in cubic feet,
w—Weight of moisture sample before drying,
w_2—Weight of moisture sample after drying,
x—Distance in feet from point of applied load to fracture.

FORMULAE.

The formulae $S = \frac{M_c}{I}$ is too familiar to warrant deduction. Of course here the pole is treated as a cantilever beam and

$$Px = M$$

$$C = \frac{C_f}{2\pi}$$

S — Modulus of rupture sought
I — Moment of inertia of a circular section

$$S = \frac{3789.9\, P_x}{C_f^3}$$

Moisture content. $\frac{w_1 - w_2}{w_2}$ expressed in per cent of dry weight.

Volume from prismoidal formulae

$$\text{Cu. feet} = .000184\left(C^2_{Top} + C^2_{Butt} + C_{Top} \cdot C_{But_t}\right)_l$$

CONCLUSIONS.

The data shows definitely that the poles are not of an economical taper.*

In most cases the weights per cubic foot and moisture content showed the poles to have been thoroughly seasoned. No consistent method was followed in seasoning and so some poles contained very large weather checks, while others, which received less rigorous treatment, were in good condition.**

The analysis of the weakness of any pole was made difficult by insufficient data on the poles before the test.

The principal sources of weakness of the Western cedar, in order of their importance, seem to be:

1. Injury to sapwood { Toredo, Bark Trimmers' ax, Bruising.
2. Rapid growth—these poles always contained excessive sapwood and knots.
3. Weather checks.
4. Knots.

No center rot was encountered.

Since the average pole has seasoned several months, a high moisture content cannot be considered a weakness.

The results obtained from Port Orford cedar were very consistent and uniform. The wood is about 17 per cent heavier and 27 per cent stronger than Western cedar, of a fine uniform grain and seems to contain few defects outside of little taper and severe weather checking. Unlike Western cedar, weather checks are an important factor in the weakening of this wood. As in the case of Western cedar, the more rapid the growth the weaker the pole and the thicker the sapwood.

The taper of Western cedar is slightly less than 3 inches in circumference per 8 feet in length. Port Orford tapers about 3 inches in circumference per 10 feet in length.

The two Western cedars compare favorably, although the data would lead one to believe that the Western cedar from Idaho should be the stronger of the Western cedars, due to a lower moisture content,‡ greater number of rings per inch, less sapwood and greater weight.† It is slightly weaker, which undoubt-

*Theoretically, the weakest section of a uniformly tapered pole is at the point where the dimensions are 3/2 of those at the point of applied load. A pole having an economical taper would break at any point. This ideal condition is seldom, if ever, reached in practice; for even if a pole could reach this severe taper requirement butt rot would soon cause the weakest section to move to the ground line.

Hence the wisdom of buying poles by circumference measurements taken at the 6-foot mark, and not by top dimensions, is readily seen. In fact the present basis of classifying poles by top diameter and length is inadequate and poor engineering practice from any standpoint.

An immense amount of inertia will have to be overcome to compel the "Once a Democrat, always a Democrat" pole dealers to adopt a logical classification of poles and resurrect the pole line from the hit or miss class and elevate it to good engineering practice.

**Bulletin 10 and Circular 108—U. S. Forest Service.

‡The strength of small timbers may be reduced over 100 per cent by the presence of moisture.

†Other things equal, the strength of the conifer is directly proportional to its weight.

Pole 20.

Pole 36.

edly is due to the severe method of seasoning and rough handling en route.

Modulus of rupture	Moisture content per cent	Sapwood per cent of total area	Rings per inch	Weight per cu. ft. lbs.	Load at failure
		WESTERN CEDAR FROM IDAHO.			
5268.53	10.1	26.254	20.324	22.741	2214.31
		LAWSON CYPRESS OR PORT ORFORD CEDAR.			
7218.38	12.016		15.99	26.654	3039.43
		WESTERN CEDAR FROM OREGON AND WASHINGTON.			
5353.185	15.152	33.99	11.933	21.947	1928.666

All the photographs of fractures are typical of the respective woods, but nearly all the poles contained some defect which either located the point of failure or reacted strongly on the strength of the pole.

Poles 1, 6, 9 and 20 are the Western cedar from Idaho. Note the shattering in 1, 9 and 20. The fracture point in pole 1 was located by bark trimmers' ax cuts. Pole 6 was badly pitted by toredo. Pole 20 illustrates the poor bond between annular rings.

Poles 36, 37 and 41 are Port Orford cedar. All three poles sheared along the grain. Note that the fracture is of a more fibrous nature. In all Port Orford poles where there were any weather checks to encourage it, the line of failure was longitudinal.

Poles 68, 72, 80 and 81 illustrate the fracture of Western cedar from Oregon and Washington.

It will be noted that two of the poles sheared at the butt failed longitudinally. The fractures seemed to be a little more fibrous and the poles shattered less than cedar from Idaho. This is probably due to a better method of seasoning and less handling.

As far as could be determined from the data on these poles no difference in strength between the winter and summer cut poles was found.

Following is a list of the average ultimate loads for various lengths of poles with various top diameters. It should be particularly noted that these results are of little value in practice, but give only an approximate idea as to the load a given pole will sustain one foot from its top, if buried 6 feet, and of the given top dimensions and lengths.

Length in feet	Approximate load 1 foot from top. Top Diameter. 6-in.	7-in.	8-in.	9-in.
	PORT ORFORD CEDAR.			
25	2500	3300	3700	....
30	2000	3100	3600	....
35	...	2800	3200	....
	WESTERN CEDAR.			
25	1800	2400	2700	....
30	1600	2000	2400	....
35	...	1900	2100	3000

Considering cedar from the standpoint of butt rot a peculiar condition exists. The sapwood on the average

View (C) of the Winch Used.

pole is about 1.62 inches thick. This sapwood rots at a rate considerably greater than that of the heartwood and probably under average conditions disappears the first or second year, representing a reduction in the strength

Pole 37. Pole 41.

of the pole about 20 per cent and the area about 30 per cent. The disappearance of the sapwood automatically raises the modulus of rupture of the pole and the rate of rot decreases upon reaching the heartwood. In the design of a pole line the replacement size should thus be considerably under the sapwood to obtain an economical life and the factor of sapwood considered in butt rot calculations, at its true value.

CALCULATIONS FOR THE WEAKEST SECTION OF A UNIFORMLY TAPERED CANTILEVER BEAM.

Let P = Applied load.

x = Distance from P to weakest section.

r_1 = Radius at P.

r_2 = Radius at weakest section.

y = Taper per unit length.

Then $r_2 = r_1 + xy$; $x = \frac{r_2 - r_1}{y}$

$m = xP$ = moment at weakest section.

L = Moment of inertia $= \frac{\pi r_2^4}{4} = \frac{\pi}{4}(r_1 + xy)^4$

$r_2 = r_1 + xy$

$$S = \text{Unit stress} = \frac{mc}{I} = \frac{Px(r_1 + xy)}{\frac{\pi}{4}(r_1 + xy)^4} = \frac{4P}{\pi}\frac{x}{(r_1 + xy)^3}$$

$$\frac{ds}{dx} = \frac{4P}{\pi}\frac{(r_1 + xy)^3 - x(3r_1^2y + 6rxy^2 + 3x^2y^3)}{(r + xy)^6}$$

Equating to Zero,

$$r_1^3 + 3r_1^2xy + 3r_1x^2y^2 + x^3y^3 - 3r_1^2xy - 6r_1x^2y^2 - 3x^3y^3 = 0$$

Or $r_1^3 - 3r_1x^2y^2 - 2x^3y^3 = 0$

$(r_1 + xy)(r_1 + xy)(r_1 - 2xy) = 0$

Weakest section is at the point where S_{max} — Solve the above equation for x and substitute for x its equivalent $\frac{r_2 - r_1}{y}$, then $r_1 \frac{2(r_2 - r_1)}{y} y = 0$.

$r_1 - 2r_2 + 2r_1 = 0$. $2r_2 = 3r_1$ or $r_2 = 3/2\, r_1$.

WOODEN POLES USED IN THE UNITED STATES.

The Bureau of the Census, assisted by the Forest Service of the United States, has recently issued a preliminary report containing some interesting data regarding wooden poles purchased by telephone and telegraph, electric light and power, and steam and electric railroad companies in the United States during the years 1907, 1908, 1909 and 1910.

The comparative purchases for the last two years are shown in tables II and III, in which it will be noted that while the telephone and telegraph companies show a slight falling off in purchases for 1910 as compared with 1909, the other classifications show quite decided gains.

Table I presents some interesting figures regarding the kind of poles purchased. It shows the undoubted popularity of cedar as a line material, and yet reveals a falling off in 1910 as compared with 1909. This, however, can be attributed more to the growing scarcity of cedar, and consequent advance in cost, than to any wane in its popularity.

The question of what kind of poles would take the place of cedar has always been a favorite theme of speculation. Several years ago the cypress was looked upon as a coming favorite, but the table shows that it is constantly growing less in favor. Among the top-notchers, oak shows the most consistent gain. Oak makes a long-lived pole, but it is to be feared that its use will also be greatly curtailed in the future by its scarcity.

Undoubtedly the pole of the future will be one which is now used in comparatively small quantities, and one of the strongest runners in this class seems to be Douglas fir. Its gains for 1908 and 1909 were very consistent, and the report for 1910 shows that nearly four times as many were used that year as in 1909.

And yet there is little need for worry over this question at the present time. The report shows that while twenty-eight different woods were used as pole material in 1910, four species—cedar, chestnut, oak, pine—contributed over 90 per cent of the total for each of the years mentioned in the report. This is certainly proof positive that the leaders are still very much in the running.

An interesting fact is shown in the steady growth of preserving methods. Table IV shows the number of poles thus treated during each of the four years mentioned, as well as the percentage of the entire number. In 1910 the electric railway, light and power companies applied preservatives more extensively than the other two classifications, they having treated 29.4 per cent of

Pole 68.

Pole 72.

their purchases. The steam railroads were second with a percentage of 19.9 per cent, the telephone and telegraph companies being a close third with 19.4 per cent. And yet the telephone and telegraph companies are such heavy purchasers of poles that, notwithstanding their low percentage, numerically they treated twice as many poles as both the other classifications put together.

TABLE I. KIND OF POLES PURCHASED.

Kind of wood.	Number of Poles Purchased			
	1910	1909	1908	1907
Cedar	2,431,567	2,439,825	2,200,139	2,109,477
Chestnut	677,517	608,066	516,049	630,282
Oak	265,290	236,842	160,702	76,450
Pine	184,677	179,586	116,749	155,960
Cypress	75,459	77,677	90,579	100,368
Douglas fir	56,732	24,877	19,542	15,919
Tamarack	30,964	29,889	24,123	13,884
Redwood	30,421	23,145	13,061	31,469
Osage Orange	23,221	21,491	18,109	5,962
Spruce	22,929	11,423	8,088	10,646
Juniper	20,042	43,581	42,367	38,925
Hemlock	12,773	6,222	1,998	3,301
Locust	9,030	10,463	10,224	4,672
All other	30,072	25,653	27,424	85,953
Total	3,870,694	3,738,740	3,249,154	3,283,268

TABLE II. POLES PURCHASED IN 1910.

Telephone and telegraph companies	2,831,810	73.2%
Electric railway, light and power	733,092	18.9%
Steam railroad	305,792	7.9%
Total	3,870,694	100.0%

TABLE III. POLES PURCHASED IN 1909.

Telephone and telegraph companies	2,926,005	76.6%
Electric railway, light and power	627,414	16.3%
Steam railroad	295,321	7.7%
Total	3,848,740	100.0%

TABLE IV. NUMBER OF POLES PRESERVED.

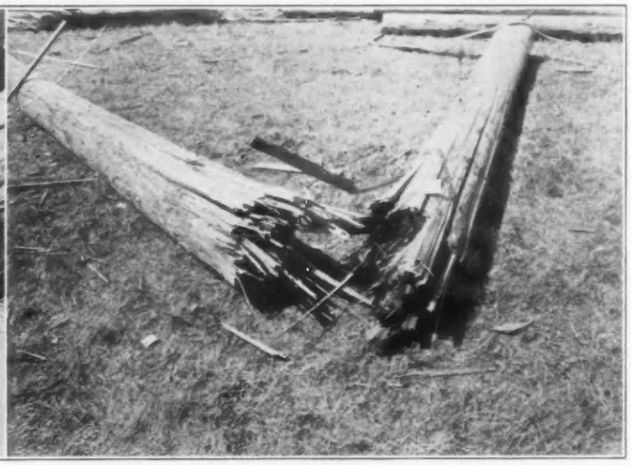
1910	824,673 preserved	21%
1909	576, 31 preserved	15%
1908	344,388 preserved	10%
1907	395,199 preserved	12%

Separate Exchange for Social "400"

If we may believe a recent report from Saint Louis, the social "400" of that progressive town will soon be able to talk to each other without the annoyance of having some of the socially impossible cut in on their conversation.

For some time the residents of a part of town lying west of Clara avenue, which comprises nearly all of the exclusive district have been complaining that whenever they called for one of their set they almost invariably got a tradesman or some other plebeian. The complaints became so numerous that the Bell company will give them an exchange of their own, so that there will no longer be any danger of the elite getting mixed up with those who don't belong.

Pole 81.



Pole 80.

What One Woman Thinks

By Sarah Elizabeth Brown

WALL STREET is still marking time—waiting. Out in the country we call it loafing. And in the country nobody has any use for a loafer. Without imposing on the truth, it is equally true that nobody in the country has any use for Wall Street. We have too many living examples of what the Street has done to the country—not for it. More than one family has been scattered to the four corners of the earth because the paternal head lost his acres in trying to play the game of the Street. The present generation of Americans know that stock speculation does not afford the best way to make a living. It is one of the reasons why Wall Street marks time. The market is dull and the value is laid at the feet of Mr. Wickersham. I hope that that gentleman is losing no sleep over the matter. The gang of martyred market manipulators are waiting to see what Wickersham will do about the disintegration plans of this or that trust. It is a fine spectacle. We find among a very few telephone people a tendency to follow the excuses of the Wall Street crowd. Mercy! what sort of minds will telephone men develop? I would prefer to believe Jim Hill, when he said that the condition of a country cannot be very alarming when its people cause the soil to produce a nine billion dollar crop once a year. The trouble with Wall Street is the increased cost of living! The increased effort in getting!

* * *

I am not much of a hero-worshipper beyond Obediah—my bread winner and the father of my children, but Jim Hill must have been reading Volney before he made his most recent optimistic speech. It sounds like a rehash of the Frenchman's work dating back a hundred and fifty years, but it fits into the present like a new velvet-ribbed union suit. Jim says that all progress is simply the development of order. We must move on along orderly lines or the end is confusion. This is a confession that Wall Street has been disorderly while it was gaining its influence upon trade conditions and it ends in confusion. It must become orderly and it is having a regular monkey and parrot time of it while the country sits back and looks on. I cannot refrain from hinting that the telephone business is built upon orderly lines. You can't serve the public with anything that offers confusion. In serving the public, our present systems are keeping pace with the development of the art, and the public appreciates that we are avoiding as much disorder as we can. Few of our stocks have found listing on stock exchanges and the markets rise and fall complying with the demands of manipulators, affecting everything but the listed telephone securities. Mr. Wickersham's activities with other corporations do not jar telephone listings. The market is firm because there can be no confusion in a telephone system that serves. Our house and our business is founded on orderly lines and French philosophers of the sixteenth century and the Jim Hill's of the present are simply confirming.

* * *

When you want to get me riled, you want to dangle that old bugaboo that the telephone business is the most hazardous of all public utilities. And I positively freeze solid when the element of competition is offered as being a portion of the hazard. When will the alleged telephone experts eliminate this bunk from their reports? When will they drop from their vocabularies the phrases of "destructive competition," "naturally risky," "needlessly imperilled"? I am told that the preface to the newest contribution to the literature of telephony was changed by the suggestion of a layman. In the idle droon of a lunk-head, the author apologized for the book, because, during the eight months of its preparation the business had turned a somersault or two, making certain parts of the work partially obsolete. The precedent of this thought was twenty years old. It was an unconscious knock at progress. It was a stumbling block for investors. There wasn't a scintilla of truth in the statement and yet there it was—poison in the preface of an authority: The author of the work knew better. He knew that the telephone business was sound; that the development was rapid; practice unimpaired by trivial remedies. Experts are egotists. They get from $25 to $100 a day for their services and to make themselves superior personages, they are eternally picking flaws in the business. No wonder that bankers duck "extra hazardous" securities when our experts rush into print with their untruthful and unwarranted comments. In eagerness to impart their great wisdom, let them consider that the first requisite is a boost. A fault can be corrected without slamming the whole game. It should not be difficult for Mr. Expert to maintain his atmosphere of supreme dignity and exalted, superior knowledge without kicking at the foundations of the structure. These men should bear in mind that money is one of the chief requisites and that some of this money has found a satisfactory resting place in the securities of telephone properties. The thing that terrorizes my nerves is men like Mr. Hagenah, employed by a great metropolis, posing as a court of last resort and handing back as a result of his findings that "the telephone business is the most hazardous of all public utility investment." It was unkind in Hagenah to say this. It was a mistake for Chicago to employ him. He might have owed his appointment to a political pull, but he should never find another job of like kind. He is of the sort that discredits years of honest effort and it is charitable to say that he is a nuisance to those men who have devoted their best years to promoting a splendid and profitable enterprise.

* * *

I am informed that the volume of money in circulation in September was $13,200,000 in excess of August. Aren't figures satisfactory to us women? Listen to this: "On the basis of a population estimated at 94,400,000, the circulation per capita (of course, I know what that means), amounted to $34.35, which represents an increase of 10 cents for the month." Hurrah, for the ten cents! That's exactly what I had left after I got my new fall hat which looks for all the world like a fuzzy ice cream cone with a feather in it. It do beat all what is offered these days to jolly us into

the belief that there isn't something the matter with the country. Ten cents for September! Pardon me while I snicker in my kimona.

* * *

By the way, look who's here, all you feeble-minded brothers and sisters who follow me in my meanderings:

Sarah Elizabeth Brown, My Dear Madam: Some unkind friend of mine "handed me" a copy of the October issue of Telephone Engineer, and in looking over the advertisements in an effort to find some long-nose pliers I accidentally, purely accidentally, I say, ran across your most tender eulogy of the *Bell Telephone News* and especially the cover on the September issue. As my hair is just washed, my cuffs nicely buttoned, and my elbows sticking to some last summer's fly paper, I take my faithful pen in hand to write you, to-wit:

Should that same kind friend of yours, or some other kind friend, mail you another copy of the *Bell Telephone News*, and you should again take it seriously—but then you could not be frivolous—and you should decide to waste some more of your good space in reviewing it, and in such article you should have occasion to make mention of the person responsible for the cover, please take it from me, his name is not Hendrick but Kendrick.

With best wishes, and trusting that the kitchen table is now clean and covered with one of those o. f. red table clothes, I beg to remain, Yours, W. M. Kendrick,

All right, Mr. Kendrick, I will apologize for the error of a proofreader. It is necessary to do it this way for my writing is so terrible I wonder that there are not more blunders. I would have you know, however, that red table covers have been nix at my house for lo, these many years. I'll stick to the oilcloth!

* * *

Here's a wheeze that I lift from the Philadelphia *Ledger* of September 15. I am thankful to the friend who sent it to me, because it affords an interesting technical problem to the high-brows who might know more about the "Bishop coadjutor-elect" than I do. It is pleasant to be told that one can talk so far with "perfect ease."

P. C. Staples, manager of the publicity department of the Bell Telephone Company, said yesterday that, through the Bishop coadjutor-elect of the diocese of loading coil and repeater, it is possible to talk over the telephone from this city to any city east of the Rocky Mountains with perfect ease.

* * *

Maybe I wasn't flirting with the truth last month when I said they were going to make the telephones pull the Chicago tunnels out of the mire! Thank goodness, though, they are going to help a little by assessing the stock $5 a share before they start. This is the newest dope I can find. A new company as a result of reorganization, to succeed Chicago subway and its constituent companies. The new company will have $24,000,000 first mortgage 5 per cent thirty-year bonds; $30,000,000 5 per cent noncumulative preferred and $22,500,000 common stock. The bonds will be A and B—twenty millions of A to be prior in lien to four million of B. The present holders of subway bonds are to be assessed 10 per cent and receive par up to the amount of the assessment in the new series A bonds and one share of the new common for each two shares of the present issue. Now, here is how it works out: There is a capitalization of $45,000,000. An assessment of $5 a share would provide $2,250,000 in cash. Exchanging the old stock for the new common would absorb all of it. The assessment on the bonds, $30,000,000 would raise another $3,000,000. There you have enough to retire those receiver's certificates that are to fall due pretty soon and enough working capital to push along the telephone development. I am glad that the telephone is to have this help, because, as I outlined last month, it was an awful lug to impose upon the gamey little instrument.

* * *

The folks who hold Cuyahoga preferred are riding easy on the presumption that J. Pierpont Morgan never loses. Morgan has the most of Cuyahoga and the $50 shares find a quick sale at $40. It is 6 per cent stuff, and holders figure it will be worth its face around the time when consolidations are in order. Morgan must realize par to get out, so the wise ones estimate and that accounts for a steady market with few transactions. Cuyahoga is a fine example of careful financial and operating development. The men who have had it in charge are immune to the assaults that have been made upon independent telephone promotors. They have a successful and modern plant and the full confidence of their stockholders. When men attain these things they are listed among the immortals.

* * *

I speak of Cuyahoga as an example of Ohio enterprise. The telephone companies in that state are arranging for telephone mergers and it will be easy for the public service commissioners to proceed if both factions present clean records. Mr. Kingsburg, representing the A. T. & T. Co., has asked the commissioner's approval of three different kinds of combinations, only one of which contemplates merger. In the smaller towns where the Bell has only a single toll station, connection will be made with the local independent company and it will be paid a certain per cent on the long-distance business thus created. Where the independents are stronger in certain of the larger cities the Bell will sell its exchanges to the independents. In places where the competing companies are about equal in strength, straight out consolidations will be encouraged. A raise of rates will probably carry in these latter points—a problem for the commissioners to determine among themselves. The scheme, as everybody knows, is a single telephone system in Ohio—an interconnected system without monopoly of control. I wonder where I first heard of this suggestion?

* * *

They are making a lot of noise in a westerly direction. Money talks. It is apt to make a noise. If you have been lying flat with your ear to the ground the silence of the past summer must have been oppressive. Now you hear rumbles of activity—always out west. The east is so quiet you don't even hear of the West Virginia National. But out west the Mountain States Telephone Company—another of those Bell groups is rattling its clapper like everything. It threatens to spend $2,000,000 right away—all for improvements and plant extension. I know that there are some telephone men who think that a transaction like this means that the A. T. & T. is going to ship its big roll from one pocket to another, but that isn't so. I know that a lot of this money is bound to find its way into the coffers of auxiliary apparatus manufacturers. Why, I actually saw with my two good eyes when I was visiting in Chicago this summer, a Western Electric truck with a great reel of S-C cable occupying the center of the stage. It was going east on Twelfth street, between Wabash and Michigan. I'd have given a cart wheel for my camera right then, but that's the

way it happened. I don't want to infer that S-C cable hasn't any business on a Western Electric truck, but it did look awfully funny to me. Nor do I want to infer that Stromberg-Carlson is an auxiliary manufacturer. I have often wondered why Mr. Kondolf of the old sewer-pipe concern at Akron, never did a great amount of advertising as a duct maker, and why he is so all-fired keen to do so much advertising as a telephone manufacturer. I'll bet there's a nigger in the kindling wood. But it don't explain that cable incident for a single minute!

* * *

I surely do amble about when I get to going. I was talking about the big noise in Denver. There is more in the same direction, but a little farther beyond. Salt Lake's the scene. Out in that town they are trying to upset the Rocky Mountain Bell's purchase of the Utah Independent. The city council is all fuddled up about that deal and they resolved a resolve or two and put it up to the city attorney. This attorney's opinion says the council can start trouble if it wants to. The old Home franchise stipulated that its successors and assigns forever must not sell out to the Bell. It must first offer the works to the city. It is difficult to figure it all out. We all remember that the concern was advertised for sale and that it went under the hammer to the highest bidder. I don't recall whether the city bid or not, but it looks like it had a chance to get something good and something cheap. Now the headlines read: "City Baffled by Telephone Merger;" "Rights of New Telephone Company May Be Tested;" "Phone (gee, I hate that word) Situation Becomes Graver," and other stuff just as ridiculous. On top of all this, the request has been made by the Bell manager for everybody to use the independent system until the Bell man make some badly needed improvements in its plant. About half a million will be required to treat Salt Lake to talking facilities.

* * *

Much obliged to meet the "Goat Man" face to face. I'm thinking there is much more for him to tell and I suggest that "Stories by the Goat Man" would make a hit with some of these old-times who are either asleep at the switch, or are waiting for lightning to strike 'em.

* * *

Heard of the newest selling scheme? If you want a new switchboard, send out your specifications now. The board will come back by "return mail." It will be installed for temporary use. You use it six months. If you like it, pay for it then or send it back. That's going some, I guess.

New York Commission News

The New York Public Service Commission, second district, has served upon the New York Telephone Company the complaint of Ludwig Stern, of 25 West Broadway, New York City, who alleges that for the years 1908, 1909 and 1910, he has been charged from his residence with approximately 4,114 calls, while he should have been charged with only approximately 2,700 local calls, and from this same telephone he was charged in 1911 up to June first with 466 local calls, and his records show but 312 calls. The complainant alleges that he believes the company's automatic registering device is not infallible in its manipulations. It is used by the various operators of the company throughout the city.

He also complains that the general message rate of five cents charged in the boroughs of Manhattan and Bronx is unfair and discriminatory, considering that the company furnishes to residence subscribers in the borough of Brooklyn an unlimited service at the rate of $48 per year, while in the boroughs of Manhattan and Bronx they are charged $48 for 600 calls per year, and five cents for each additional call.

The commission is asked to make an adjustment of rates and to provide a more suitable system embodying greater degrees of accuracy in its system of recording local calls from telephone stations.

The commission has received a complaint from Charles Berger of New York City, a subscriber of the New York Telephone Company, directed against that company, asking that the commission make an order directing and requiring the telephone company to adjust the rates charged for local messages in excess of those included in the yearly rate on the basis of allowing any unused messages to apply as a credit to any succeeding year of such contract.

He states that during the year 1910 he used about 650 messages, during the year 1909, about 400 messages, and during the year 1908 about 225 messages, while up to October first this year he has used about 825 messages, for which the company is charging him $4 per month plus 5 cents for each local message. He alleges that it is unreasonable for the company to charge him for excess local calls above the 600 for this year, when during the years 1908 and 1909 he only used about half of the 600 calls allowed under his contract each year, and also that it is unreasonable to charge him $4 per month in addition to the 5 cents for each message that he has been charged with since the 600 local messages were used.

The commission has received a complaint from certain residents of Warsaw, Wyoming county, asking that the American and Wells Fargo express companies be required to provide facilities so that subscribers to the Federal Telephone and Telegraph Company may reach these offices by telephone. The complainants state that a large number of business men are unable to reach these express offices by telephone, whereas subscribers to the Bell telephone are afforded that convenience.

The Commission is asked to make an order requiring the express companies to install the Federal or Home telephone in their offices.

Uniforms to Save Linemen from Bullets

As a result of the recent killing of a lineman who was mistaken for a cougar, says the Gooding (Idaho) *Herald*, the telephone linemen operating out of Port Townsend, Wash., have adopted a bright red uniform as a protection from amateur hunters, who are now taking to the woods and are likely to shoot in the direction of the first thing that they see moving.

Under the law, dogs cannot be used, so "still hunting" will be the method. The linemen feel that this will place them in jeopardy, as the hunters will station themselves at a convenient place to await the approach of game.

The red uniform, the linemen claim, will afford them some protection against being shot.

The Telephone Scrap Book

Submarine Telephone Line in Motor Boat Race

MOTOR boat races held off Exhibition park at Toronto, Canada, September 4-9, were handicapped through the use of a submarine telephone line—the first time, it is claimed, that the telephone has ever been used for that purpose.

It seems that the races held last year were somewhat unsatisfactory to both the spectators and the

The Telephone Equipment. Timing at the First Buoy.

participants owing to the inadequate system of signaling and timing. Flags were the principal means of conveying information, and these were very frequently obscured by the smoke of passing steamers and the dull haze which hung over the water. Confusion of the signals and debates between the boat owners and officials plainly indicated the need of a quick and positive means of communication.

So the Canadian National Exhibition Race Committee decided that the races this year should be the best that the exhibition has ever known. And they were. Every boat was supplied with a numbered burgee and a large bulletin board on the old Dufferin street wharf informed the drivers of the competing craft of their proper position in starting. Almost all of the races were handicaps; these handicaps were decided by the time taken in running the various boats over a measured mile course.

Accurately to measure the elapsed time a submarine telephone line was laid between the Dufferin street wharf and a scow anchored a mile out in the lake, this being the first buoy. Major S. A. Sylvester of the Toronto Motor Boat Club was seated on the scow provided with a stop watch and gun. As each boat crossed the line he fired his gun and at the same time operated with stop watch. At the other end of the telephone on the wharf Captain J. P. Beatty sat with the receiver to his ear; he heard the report of the gun instantly and started his watch, stopping it as the boat passed him. This method gave a double check on the elapsed time, and the results obtained were so accurate that in no case did they check a fifth of a second out.

The wire used for the submarine line was of No. 18 B. W. G. wire provided with double impregnated braiding twisted in a pair. The instruments were two standard series magneto desk telephones specially equipped with an operator's headband receiver so as to allow the timers to use both hands. No trouble whatsoever was experienced in relation to either the instruments or the wire, notwithstanding the fact that they were exposed to the action of wind and waves throughout the race event.

Shooting a Line Across a River

A SMALL mortar, used for shooting a life line to a wrecked vessel, was utilized by a telephone repair crew at Los Angeles to get a broken wire across a river, according to *Popular Electricity*. The stream was one of the sort which is very common in dry countries, a bed of sand through the summer and a raging torrent after a heavy rain. During the last rainy season it washed away the long distance telephone line and there was no way to cross the swollen stream to repair it. No boat could live in such a current, while quicksand and rolling boulders made it hazardous for a horseman to attempt to ford it. The problem was ingeniously solved by a message to the nearest beach, where a life-saving station was located. The small cannon, life-line and a can of black powder were sent to the river bank, where the gun was charged and aimed across the stream. The result of the explosion was successful, for the projectile carried one end of the coil of rope more than a thousand feet to the other bank; the telephone cable was attached to the other end of the rope and dragged

Shooting a Line Across a River.

across by men on the opposite side and service was resumed in short order. A mortar of similar design, mounted on an automobile, is to be used as part of the repair outfit in the future, according to the foreman who carried out the unique plan.

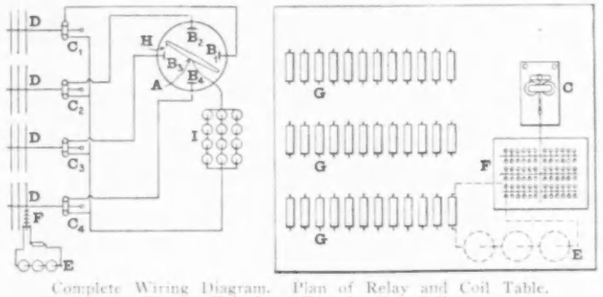
Dry Cell Testing

AN INTERESTING paper on dry cell testing was read before a recent meeting of the American Electrochemical Society by W. B. Pritz. In regard to the terms in which the rsults of dry cell tests should

be reported, there is some difference of opinion, some authorities contending that the ratings should be expressed as the number of ampere-hours given by a cell under specified conditions to a certain working voltage value. Others claim that more practical meaning is attached to a statement of the length of time during which the cell is able to maintain its working voltage above the specified limiting value. It is the author's opinion that that method of rating should be used which gives to the consumer the exact information which he desires, hence, the rating of cells by the length of service of a given kind which they are capable of giving is favored.

It is perfectly evident that the consumer is interested in the length of service which he is able to obtain from a battery, and not in the amount of energy given. At first thought it might appear that the ampere-hour capacity of a dry cell bears such a relation to length of service that either method of rating would give the same information. Such is not the case, however. Differences in discharge rate cause vast differences in the number of ampere-hours obtainable from the cell. From the nature of the discharge curve, it is quite difficult to calculate the length of service obtainable under the conditions limiting the ampere-hour rating, while to go further and deduce from the rated ampere-hour capacity under one set of conditions, the output to be expected under different conditions becomes a hopeless task. Equally hopeless is the final interpreting of the result in terms of length of service. Again, a dry cell does not always give length of service which is proportional to ampere-hour output. It is easily possible to produce two dry cells which will give equal lengths of service, the ampere-hour output of which will show marked differences. Hence a statement of the ampere-hour capacity of two brands of cells is very apt to be misleading, as it does not settle definitely which is the better cell to use upon a given service. For research purposes the energy or ampere-hour output of a cell is very useful, but as a practical rating for dry cells it is not satisfactory, especially from the standpoint of the consumer.

The author then proposes for consideration cer-



Complete Wiring Diagram. Plan of Relay and Coil Table.
Fig. 1. Telephone Test for Dry Cells.

tain tests covering the two most important services, namely, telephone and gas-engine ignition.

It is recommended by one of the important telephone companies that the battery should at all times give a current of more than 0.14 amps. at the end of one minute after it has been disconnected from the transmitter and connected in circuit with an ammeter and a resistance of 20 ohms. This specification necessitates that the working voltage be constantly 2.8 volts or more. The author has been using for some time a test which requires a minimum of care and supervision and which is quite comparable to the more complicated tests. It subjects three cells in series to a discharge through 20 ohms resistance for a period of two minutes each hour, during 24 hours per day and 7 days per week, until the working voltage reaches the limiting value of 2.8 volts, the results being reported as the number of hours' service to this cut-off point. The energy drawn from the battery in this test is approximately equivalent to that consumed in the more complicated methods; the batteries give

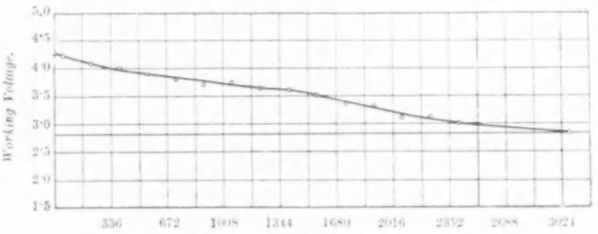


Fig. 2. Hours on Test.

practically equivalent periods of service, and the number of cells, resistance in circuit, and cut-off point are identical. The regularity of this test which we propose eliminates the mechanical appliances necessary to obtain decreased night and Sunday service. The left-hand portion of Fig. 1 shows diagrammatically the apparatus necessary and its arrangement. The hand of the clock A revolves once per hour, closing by means of the contact H the circuit of the battery I in turn through the contacts B, B_2, B_3 and B_4. This current magnetizes the cores of the telegraph relays C, C_2, C_3, C_4, causing the extended armature arms D to fall, bringing the inverted U-shaped fingers F into mercury cups, through which the test battery circuits E are closed. Each contact B is of such length that two minutes are required for the passage of the contact H. At the right of the figure is shown the arrangement of the relay and coil table. The test batteries are stored underneath the table and are read from the mercury cup F.

Figure 2 shows a representative discharge curve obtained from a battery of three 2½ by 6 inch dry cells of a well-known brand. The curve passes through the values of the working voltage at the end of the discharge periods.

An Improved Wireless Transmitter

QUITE a lot of trouble has been experienced in wireless telephony in attempting to get a transmitter that would withstand the current, ranging from 1 to 6 amperes, and at the same time respond to the variations of speech. In order to overcome this difficulty several attempts have been made to obtain a stronger effect by a number of loose contacts, or several diaphragms, actuated by the same mouthpiece. In all these cases, however, it was found that when the energy is increased, distinctness is sacrificed.

A transmitter was built up according to the plan shown in Fig. 1 by William Dubilier. The transmitter complete consists of the magnets A, A, wound with the two-ohm windings B, B, and placed opposite to each other with the diaphragms and carbon containing cup between. The diaphragms are approximately 5 inches in diameter and 1/28 inch thick. The ebonite

disc *D* is used to mount the diaphragms on and is drilled with large-sized holes so as to prevent "air packing" or talking against one another.

The carbon-containing cup resembles three brass rings placed within one another, forming three independent containing portions. Water circulates through the chambers by means of inlet and outlet tubes and

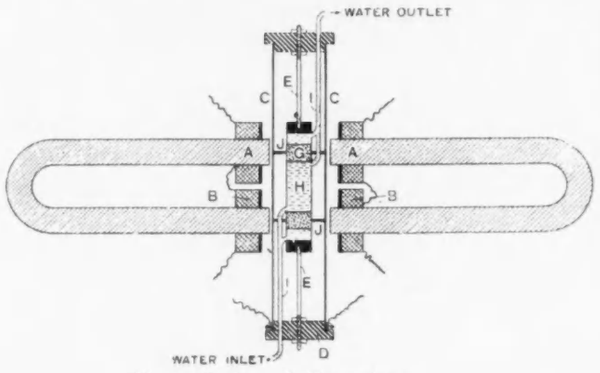
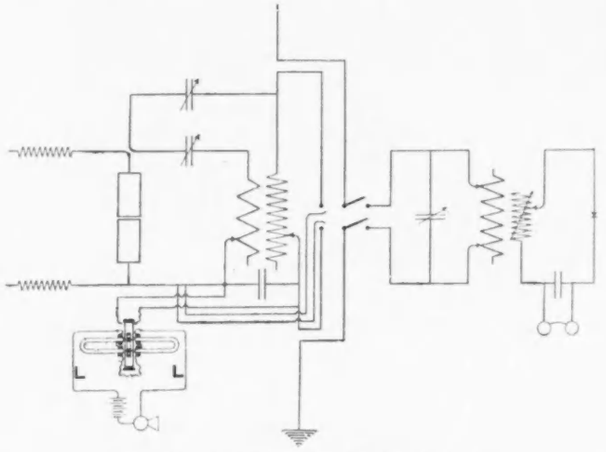


Fig. 1.—Section of Transmitter.

the middle chamber is used to retain the carbon granules. To make contact with the granular mass circular rings of platinum are used, which are first soldered to the diaphragms. The platinum rings are drilled with small holes round the entire circumference so as to allow a free circulation of air, and through one of these holes the small inlet and outlet tubes are run. The contact is made in the center of the granular mass. A mica disc is used to retain the granules in the chamber.

A local transmitter is connected in series with a set of dry cells and the windings *B*. Leads are taken from the diaphragms to the aerial circuit. When the transmitter is spoken into, the current flowing round the windings varies the magnetic pull of the magnets in the usual manner, and the diaphrams, *C C*, are set in vibration to the same proportion. The maximum



Circuit of the Dubilier Wireless Telephone.

vibration should be figured as the resultant of the two; that is, for the sake of illustration, consider that the maximum vibration of each diaphragm is 1/16 inch, the result would be equivalent to ⅛ inch; for each diaphragm works oppositely in the same proportion.

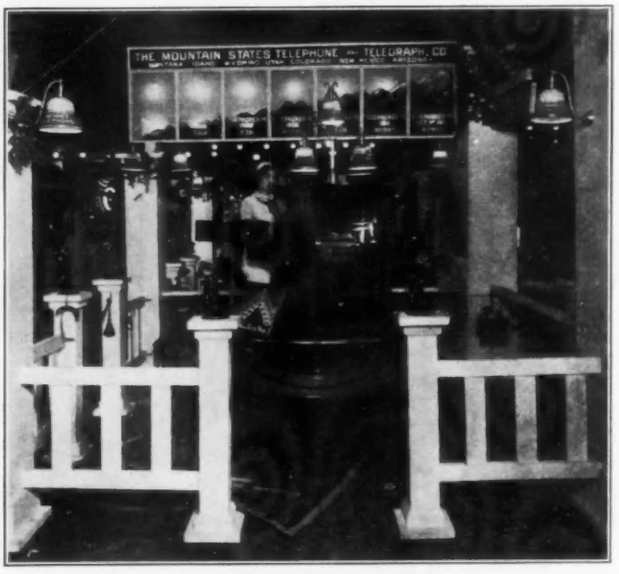
The main feature against using this type of transmitter is the difficulty of constructing and adjusting. However, in actual practice it gives the desired results and comes near to being the ideal transmitter for heavy currents.

Figure 2 is a wiring diagram of the Dubilier wireless telephone system, showing the method of connecting the transmitter, from which it can easily be seen that wires *L, L,* can easily be made the line wires, and so it is possible to have a telephone system consisting partly of wire and partly wireless transmission, and which may make it possible for a regular telephone subscriber to talk to a boat without any further equipment at his home.

Revolving Exhibition Switchboard

AT the Denver Electrical show, held in Denver, Colo., last week, the Mountain States Telephone and Telegraph Company had a very interesting exhibit.

The main feature of the exhibit, which was contained in the booth shown in the picture, and the one



Mountain States Telephone Exhibit.

immediately behind, was the eighty line lamp switchboard, fully equipped, mounted on a six-foot revolving platform, 21 inches above the floor, this platform making but one revolution before it reversed. Every exhibitor in the show was furnished telephone service, and calls to the various stations were handled through this board, so that the switchboard was in active operation during the entire show. Gearing, belting, and half horse power motor for driving the platform were mounted on its under side. The back of the switchboard was enclosed with glass, permitting all the intricate mechanism to be viewed by the public. This booth was railed off against admission, but the other booth was open to the visitors, and a public station installed for the use of those who might desire to use the service. The large illuminated flash sign which extends across the back of the picture represents by graduated mountains the growth of the company since its inauguration in 1880.

In the second booth there was a map 9x6 feet of the company's system in colors. A pyramid of desk sets, several appropriate show cards, with telephone desk sets on newel posts, easy chairs, Navajo rugs, etc., completed the exhibit, while the lights were shaded by the familiar blue bell globes bearing the trade-mark slogan, "The Local and Long Distance Telephone."

J. F. Greenwalt, publicity manager, has charge of the arrangements of the booth, and N. O. Pierce, plant superintendent, arranged for the installation of the switch board and wiring of the auditorium, the latter being done under the immediate supervision of S. F. Peyton. G. H. Althouse represented the commercial department and F. H. Yelton supervised the traffic load, which was handled by three operators working one shift each.

Fungus Growth of Wood Decay

FUNGUS growths that act as agents of decay in the cells of wood are interestingly described by W. H. Matthews in the *Post Office Electrical Engineers' Journal*, London.

In order to make clear the chief points about wood-destroying fungi, it will be most convenient to describe one as a type and indicate the way in which others differ from it. In Fig. 1 is shown diagrammatically a

Fig. 1.—A fungus of the mushroom group: *m*, mycelium; *sp.*, sporophore; *s*, stalk; *c*, cap; *g*, "*gills*" or "lamellæ"—radiating plates upon which the spores are produced.

fungus which is typical of a very large group, including the common mushroom and one or two of the wood-destroying fungi. Two main portions may be distinguished—the internal portion, growing in the timber or other nutritive substratum, and the external portion growing in the air. It is the internal portion, or mycelium, which does all the direct damage. The external portion, or sporophore, is only concerned with the manufacture and distribution of the tiny "spores" by means of which the fungus can reproduce itself in distant places.

The mycelium consists of an interlacing system of fine tubes appearing to the naked-eye as a silky or felt-like mass of white threads; these threads are called "hyphae." Each hypha is composed of a thin transparent tube of a substance allied to cellulose, divided at intervals by cross walls into distinct cells, each containing, as in higher plants, living protoplasm and drops or granules of other substances. Here and there are curious outgrowths forming connections between one cell and its neighbor, called "clamp connections."

The hyphae absorb from the surrounding medium the available nutrient materials, and their free ends grow in length and, branching at intervals, seek out fresh food stores as the immediate supply becomes consumed.

This vegetative growth may go on for a considerable time, no external signs being visible, but under suitable conditions certain of the hyphae will at length emerge into the atmosphere, and becoming closely in-

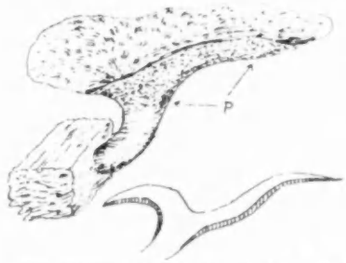


Fig. 2.—A species of *Polyporus* growing on a piece of wood; *p*, pores.

terwoven, will form a structure whose function is to bear spores, and which is therefore named the sporophore.

A fungus belonging to the same order as that which we have selected for a type is Lentinus lepideus, which destroyed the paving blocks of Birmingham a few years ago. The blocks, which were of pinewood, had been dipped in creosote, but had not been injected. They rotted to such an extent that they would crumble in the fingers, and it become imperative to take them all up and to re-pave the area. When Dr. Buller, who investigated the matter, kept some of them in a close moist atmosphere for a time the sporophores of the fungus soon appeared.

The majority of the wood-destroying fungi belong to an order in which the spore-producing layer is distributed over the inner surface of the little tubes which appear from the outside as pores, circular or polygonal. A common fungus of this order, named Polyporus, is shown in Fig. 2; it infests oaks. The most well-known and greatly dreaded member, however, is Merulius lacrymans, the fungus of "dry rot," which is shown in Fig. 3. This fungus is very common in cellars and

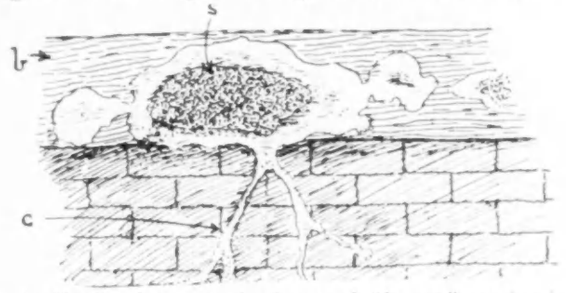


Fig. 3.—*Merulius lacrymans*, the fungus of "dry rot," growing in a beam, *b*, producing a sporophore, *s*, and sending out conducting strands, *c*.

mines, and in badly ventilated situations generally. It usually attacks coniferous timber, but may also live on oak and other hardwoods. Its earliest indication is the appearance of "red stripe" in the timber when sawn. Later on the fungus appears at the surface of the wood and forms white felted tufts, sheets and strands, which later assume a dirty greyish hue. (In

the case of Polyporus vaporarius, which forms similar sheets, the white appearance is retained throughout.)

The "dry-rot" fungus resembles an electrical "dry" cell in one particular, namely, that when quite dry it cannot work; it must have moisture. Its specific name, lacrymans ("weeping") has reference to the drops of water which it excretes in abundance when growing in a sufficiently moist atmosphere.

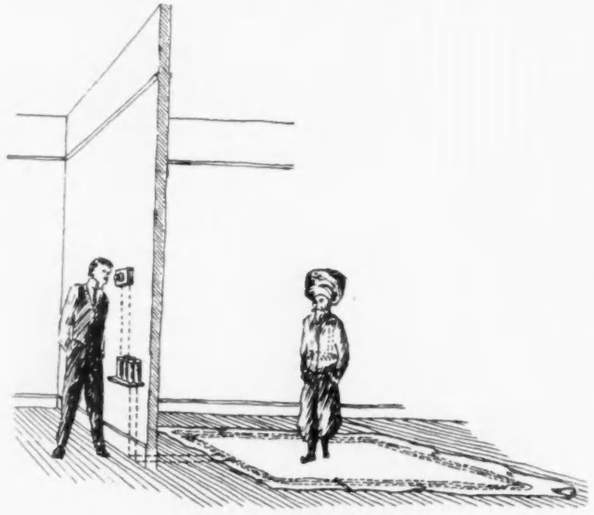
The hyphae of the dry-rot fungus attack the walls of the wood-cells by giving forth certain ferments which decompose the lignose and cellulose of the cell-walls, leaving only the gums, resins, tannins, etc., which are very friable. When the fungus has exhausted any part of the timber the hyphae in that portion shrivel up, and after a time it is difficult to find any traces of them. The timber is then in the "dry rot" condition and is so brittle that it will easily crumble between the fingers.

Other fungi have rather different modes of destroying the wood; for instance, Bulgaria polymorpha, which may often be noticed in the form of little black cups on oak palings, converts the lignose of cell-walls into cellulose and removes the calcium pectate that binds the cells together.

A Mind Reading Telephone

THE adaptation of a sort of wireless arrangement, or rather an inductive telephone, to the intricate processes of mind reading for pay, is described by Carl L. Carver in the *Mountain States Monitor*.

It seems that a gentleman of Hindoo nomenclature recently hung out his shingle in Victor, Colorado, announcing to the world that he was gifted with the



The Mind-Reading Telephone.

power of telling anything one wished to know. At first everything went well, and his prognostications were the talk of the town, but later he evidently had "trouble," as Mr. Sarver's telephone rang at one-thirty a. m., and the "Prof." informed him that it would be to the advantage of his bank account to call at his apartments immediately.

After the professor had securely bolted the door, he explained, in a much broken and excited voice, that "his outfit was bad." He then got out a carpet which had 18 wraps of No. 19 B. & S. copper wire sewed in a neat coil on the under side, the two ends of this coil ran under the door and into the next room, where there were three dry cells on each end, and a low resistance transmitter across the other end of the cells.

The rest of the professor's mind reading "power" consisted of the same amount of No. 19 B. & S. made into a neat coil, the exact size of his waist, worn under the clothes and held in place by a pair of suspenders. To the terminals of this coil were fastened an ordinary operator's head set, which was very completely covered by the Hindoo's turban. When his victim entered he was told to write his name, age and whatever other information the "Prof" wanted, on a slip of paper. This was put into a velvet bag within reach of his assistant in the next room. The questions were also written on this slip.

He then paced back and forth on his carpet, and as his assistant read the name, etc., he repeated them to Mr. E. Z. Mark, as his receiver and coil picked up, by induction, the words spoken in a whisper by his man in the next room, twenty-five feet away. This put the utmost confidence into the mind of his victim, and he then answered the questions in most any manner he saw fit.

His trouble was similar to most troubles we are familiar with, the lack of solder.

Telephones in Austria

Great activity prevails at the present time in Vienna and throughout lower Austria in connection with the extension of the telephone system. The whole area of the capital city is being equipped with telephone lines and exchanges at suitable intervals, and the work will extend well into next year. Besides the main scheme, a series of block systems will be set up. Outside Vienna and throughout the length and breadth of Lower Austria the improvement of existing installations and erection of new ones is in full swing. In some 30 towns, telephone service will be established for the first time, while in 16 others new installations are already under way, and partly completed. The public call for telephone convenience is indeed so extensive and widespread that it already exceeds the funds available for such works. Next year's budget will have to provide a credit vastly in excess of that allotted last year to telephone construction purposes, and even then the great public demand will not be satisfied. As a consequence of the cable laying operations in progress in Vienna, Lower Austria and the several Crown lands, valuable orders for material are being placed by the Post and Telegraph administration. The cable manufactures are especially affected, and several of them have asked for time indulgence on the completion of contracts. The telephone apparatus industry, which had previously been suffering under a period of stagnation, has received many welcome orders for telephone station equipment, and other contracts may be expected to follow the completion of those already in the factories, Austria until recently always having been somewhat behind in the matter of telephone conveniences, as is shown by the fact that in ten years the telephone network has only increased from 5,622 miles to 6,683 miles.

The Loading of Long Distance Lines

By Bancroft Gherardi*

THE method of placing loading coils in cable circuits is illustrated by Fig. 8, which shows the photograph of a manhole containing loading coil cases. The cases in this photograph each contain 49 loading coils. These are arranged in the case on seven spindles, there being one spindle in the middle of the case and six spindles arranged around it. The case is filled with insulating compound and special precautions are taken between the flanges to exclude water. Extending from the case to the main cable is a stub cable containing the wires leading into and out of the loading coils. This is spliced into the main cable so as to loop a loading coil winding into each side of each circuit which it is desired to load. In some cases where it is desired to load aerial cables, cases similar to those shown in Fig. 8 are buried at the base of the pole and the stub containing the wires run up the pole to connect with the aerial cable.

*LOADING OPEN WIRE LINES.

Gratifying as have been the results obtained from the use of loading on underground cables, its application to open wire circuits has also resulted in most noteworthy

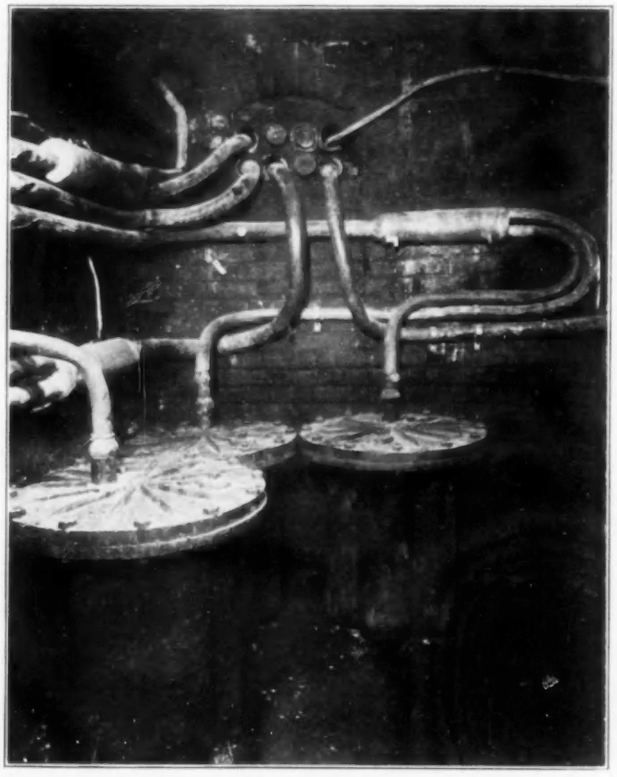


Fig. 8. Underground Man-Hole Containing Loading Coils.

improvements in their efficiency. The general plan of loading open wire circuits is similar to that used on underground cable wires. On account of the differences in the electrical characteristics of open wire circuits, as compared with cable circuits, however, the design and spacing of the loading coils is materially different from the coils and the spacings used on underground cables. In general, only heavy loading is used on open wire lines

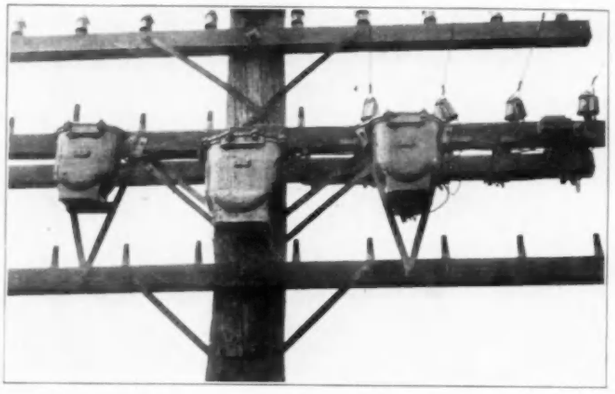


Fig. 9. Loading Coils Placed on an Open Wire Line.

on account of the greater length of these lines. The coils themselves are substantially larger than those employed on cable circuits for two reasons—in the first place, the coil is subject to damage by lightning. In order to minimize this difficulty the coils must be built to have high breakdown strengths against lightning discharges. All aerial coils are built so that they will stand a breakdown test of 8,000 volts. This, of course, considerably increases the size of the coil. The coil is futher increased in size by the fact that, as an aerial circuit is initially a good deal more efficient than an underground circuit, it is necessary that the coils used in loading it should have smaller losses than are permissible in underground cable loading coils. The outside diameter of the aeriel loading coil is about 10 inches, and the resistance of the two windings of the coil to direct current is 2.5 ohms, while to alternating currents of a frequency of 800 periods a second it is 6.5 ohms. In addition to building the coil so that it has a breakdown strength of 8,000 volts, each coil is protected by a pair of lightning arresters adjusted to operate at 3,500 volts. These precautions have proved sufficient to reduce trouble from lightning on aerial loading coils to a neglible amount.

Low insulation which is sometimes encountered on open wire lines, particularly in periods of bad weather, proved at the start a serious difficulty in connection with the loading of open wire lines. This, however, has been overcome by removing the worst causes of low insulation and in some cases by the use of improved insulators, and at the present time low insulation is not proving a serious factor in connection with the application of loading to overhead lines. In wet weather the transmission efficiency of overhead lines is not quite as good as in dry weather, but it may be stated that it is very seldom that the loaded circuits fall in efficiency sufficiently to seriously affect the transmission, except in cases where the

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lines are in actual trouble from branches of trees falling into the line, or other similar causes.

In connection with the loading of open wire lines the problem of arranging them so that they will be free from substantial crosstalk has required attention. Due to the fact that much of the crosstalk disturbances in telephony are from electrostatic induction, it is to be expected and it is found in practice that the loading of a circuit increases its tendency to crosstalk. In the early applications of loading to open wire lines some trouble was experienced from crosstalk and special transposi-

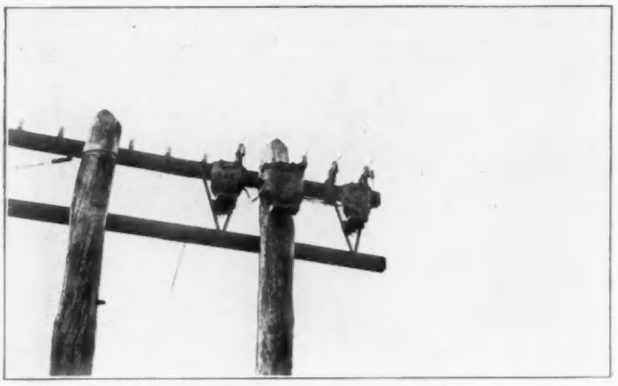

Fig. 10. Loading Coils Placed on an Open Wire Line on "H" Fixtures.

tion systems were devised to overcome these difficulties, and it was further found necessary to locate the loading coils with special reference to the transpositions. On underground cables it has been found that loading also increases the crosstalk somewhat, and in these we arrange to reduce the capacity unbalances in order to reduce crosstalk to a sufficiently low point.

The loading coils for use on open wire circuits are placed in individual cast iron cases and these are placed on the poles or crossarms as in Figs. 9 and 10, which show illustrations of two common arrangements. The line is carried to the loading coil by means of bridle wire. The lightning arrester is placed in a separate case and bridle wire is also extended to it.

The results obtained by the use of loading coils on the No. 8 B. W. and No. 12 N. B. S. gauge wires, which are the standard sizes used in the long distance plant of the Bell system, are shown in Fig. 11, in which, for the purposes of comparison, the efficiencies of the unloaded circuits are also given. This diagram shows terminal losses with the conditions which may be considered as average. The general reflection loss problem with overhead lines is the same as with underground cables, and having been discussed in detail in connection with such circuits it need not be repeated here. As will be seen from Fig. 11, the results obtained from loading open wire lines have been to more than double their transmission efficiency when used in considerable lengths.

One of the very valuable results which has followed from the loading of open wire lines has been that it has made a very substantial extension to the distance over which long distance service can be given. Up to the time that loading was successfully applied to No. 8 B. W. G. wires, about 1,000 miles represented the greatest distances over which commercial service was maintained. By the loading of No. 8 circuits this has just been extended to 2,000 miles, so that today it is practicable to obtain a successful telephone conversation from New York to Denver. The actual distance between these two points by the route which the line follows is 2,010 miles.

A very important use has been made of loaded cables in bringing loaded open wire lines into large cities. Loaded cables have also been used to bring unloaded open wire lines into thickly settled communities, but in this case the gains have not been so great because it is not practicable to place terminal transformers for reducing the reflection losses between the outer end of the underground cable circuits and the aerial lines, and hence reflection losses are experienced.

This practical impossibility of placing reflection reducing devices between open wire and cable has also made it impossible to obtain the full benefits from loading in those cases where short stretches of cable are placed in the middle of toll lines—*e. g.*, in communities where the appearance of the open wires is objected to and requests are made to place them underground. If the open wires are loaded the trouble is not so great as a comparatively heavy loading can be used without excessive reflection losses. For non-loaded open wires, the loading of the cable, if attempted at all, must be very light if the reflection losses are not to offset any gain from the reduced attenuation.

For these reasons and also because cable circuits loaded or non-loaded are inherently less efficient than open wire circuits it is important that every effort be made to keep toll lines as free as possible from cable.

LOADING OF SUBMARINE CABLES.

The problem of loading submarine cables is a mechanical one rather than one concerning the principles of loading. In this country a 16 B. & S. G. dry core paper submarine cable about 5 miles long and containing loading coils spaced about 2 miles apart has been successfully laid across the Chesapeake Bay and is now in operation. There has also been talk of laying a dry core loaded submarine cable across Puget Sound for a dis-

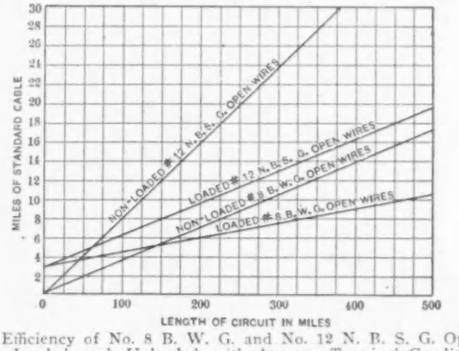

Fig. 11. Efficiency of No. 8 B. W. G. and No. 12 N. B. S. G. Open Wire Lines Loaded and Unloaded with Average Terminal Conditions.

tance of 16 miles. The situation in the United States, however, is not such that large numbers of loaded submarine cables of any great length are required. Abroad, however, particularly between England and the continent and between England and Ireland submarine cables of considerable length are needed for telephone purposes and in these situations loaded gutta-percha submarine cables have been employed with successful results.

EXTENT OF APPLICATION OF LOADING.

It is evident that a device making such great improvements in the transmission efficiency of telephone circuits as does loading would have a large place in the

plant of any company providing a comprehensive system of telephone service over a large area, a condition necessarily requiring long cables and long open wire lines. Although the loading art was born in 1900, and its successful commercial application on an extensive scale to our plant dates only from about 1903, there are already in the United States over 85,000 miles of loaded open wire circuits and over 170,000 miles of loaded underground cable circuits. To load these circuits there have been employed about 125,000 loading coils. The day-by-day experience with this enormous loaded line plant has fully demonstrated that we are in practice obtaining the successful results which the engineering data that I have set forth would lead us to expect.

The facts which have been herewith developed have, I think, been more than sufficient to justify the statement at the beginning of this paper, that the year 1900, in which the loading patents were issued to Professor Pupin, marked the beginning of an important era in telephone work. I do not know of any problem in electrical science and electrical engineering which has required greater skill, technical ability and diligence on the part of those engaged in its solution—inventors, engineers, manufactures and construction people—than has the working out and the application of loading.

Joint Telegraph and Telephone Offices

In the past the relations between the telephone and telegraph services have been confined principally to using each other's wires, but now they are to be brought still closer together in the eastern division of the Western Union Telegraph Company. To bring about increased efficiency, a system of joint offices is being put into effect. In many of the smaller communities, the only telegraph office is in the railroad station, under control of the railroad agent, and usually it is located at some distance from the business center of town. It is open for business, as a rule, only during day hours. On the other hand, the telephone office and exchange is centrally located and is open for business day and night.

Many small communities have no telegraph office at all, but are reached by the telephone. These will now have a Western Union office. In working out a plan to meet the varying conditions it was found advisable to divide the joint offices into four classes, designated as Class 1, Class 2, Class 3 and Class A. Class 1 is an office turned over by the telegraph company to the telephone company for the latter to operate telegraphically as agent of the former. The telegraph company runs its wires to the telephone office and furnishes the necessary equipment. Offices of this class will be in the larger towns and villages where there is sufficient volume of business to require the services of a telegraph operator. The telegrapher will be an employee of the telephone company, but performing both telegraph and telephone duties. Separately, there would not be enough duty to occupy the time of an employee, but the joint service permits economical operation of the office. So far as the telegraph part is concerned, the routine of the office, the keeping of records and the making of reports will be the same as at regular telegraph offices.

Class 2 offices are identical with those of Class 1, save that they are not operated telegraphically, but entirely by telephone; that is, the business being of too small volume to warrant the services both of a telegraph operator and telegraph installation, it will be transmitted by telephone to the nearest independent Western Union office. At Class 2 points, telephone subscribers will be connected directly to the Western Union office, to which the business is transferred, but anyone desiring to personally file a message may do so, in which case the employees of the telephone company will transmit it to the telegraph office.

On the other hand, business destined to Class 2 offices will be telephoned by the telegraph office to the telephone subscriber. If the addressee has no telephone, the transfer telegraph office will telephone the message to the telephone operator for delivery from the Class 2 office. There will be no additional telephone toll charges for customers at Class 2 offices. The standard telegraph rates will apply.

Class 3 offices will include such stations and toll stations as may be agreed upon at points where the telephone company does not operate an exchange and where at the present time an additional toll line charge is exacted. It is proposed, so far as the telephone company can control such points, to make them Western Union offices and eliminate the toll line charge. The method of operating these offices by telephone is identical with those in Class 2.

The Class "A" offices will include those now known as "Public Pay Stations" in cities and towns where the telephone company's attendants will accept and forward telegrams to the local telegraph office, the attendant acting as agent for the telegraph company. No telephone toll charge is to be made to the person desiring to send telegrams at such stations.

In the Eastern Division up to September 15, sixty-two offices of Class 1 type are being operated by the Associated Bell Companies or are in process of installation. Most of these are in New England, but the New York Telephone Company is inaugurating the same policy in its territory.

A large number of Class 2 and Class 3 offices have been, or soon will be, taken over by the Associated Bell Companies. Of the Class A type, there have been 983 offices already established.

The public will appreciate this combined service because it will afford continuous telegraph service at practically all Class 1 and Class 2 points, where formerly there was a limited hour service.

In addition, there will be abolished the extra charges on telegrams that have heretofore been imposed on many small communities not reached by the direct telegraph lines.

A German Precaution

An investigation was recently made in Germany to determine whether any accidents had ever been caused in gas works by the ignition of gas with sparks from the telephone instruments or wires. No such accident had ever been reported, although by experimenting it was found that gas could be ignited in this way if it were projected upon the instruments while they were in operation. After the test, the Association of German Gas and Water Works has decided to permit the use of telephones in gas works provided the instruments be protected by a guard of fine wire gauze.

Preservative Treatment of Poles

Compiled by William H. Kempfer*

GENERAL PRINCIPLES OF WOOD PRESERVATION.

EXCEPT in very warm and moist climates, a pole which is placed on skids and allowed to become air dry does not decay, because it does not contain sufficient moisture to support the growth of fungi and wood-boring insects, which are the causes of decay. However,

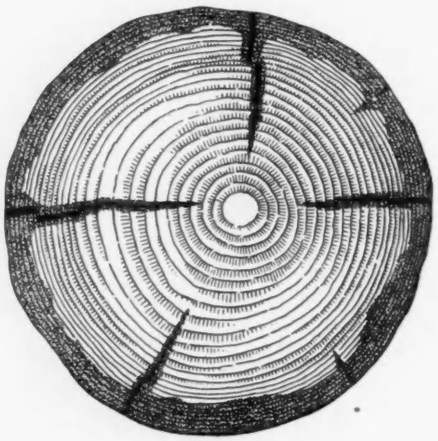

Fig. 1.

if the pole is set, that portion of it in contact with the soil will absorb moisture until conditions favorable to decay are restored. To prevent decay in timber exposed to the soil or moist air, the wood substance, which is the food of the decay-producing organisms, must be rendered incapable of supporting fungous growth. In commercial timber-treating practice this is accomplished by the injection of antiseptics.

It is not usually practicable, even with the best methods of treatment, except in the case of very porous woods, to impregnate the wood throughout. The value of the treatment consists largely in creating an outer protective envelope around the untreated interior wood. The thickness necessary for this envelope to give efficient protection depends on the use to which the timber is to be put. In general, the antiseptic should penetrate deep enough to prevent exposure of the untreated wood by abrasion, checking, or other action. Since the liability of the protective zone to destruction from mechanical causes or by gradual volatilization of the oil is dependent on its thickness, or, in other words, on the quantity of preservative absorbed and the depth of penetration, it is reasonable to assume that within certain limits the added life of the timber due to treatment with a given preservative will be in approximate ratio to the amount of penetration and absorption of the preservative. Fig. 1 shows the decayed condition of an untreated pole of southern white cedar after four years' service. Fig. 2 shows a creosote Loblolly pine pole after eighteen years' service. There is no sign of decay.

*From United States Forestry Service Bulletin No. 84.

FOREST SERVICE INVESTIGATIONS.

Knowledge of the results of creosote treatment is based largely on treatments made by the pressure method, using from 8 to 12 pounds or more of creosote to the cubic foot of timber. In spite of the excellent results that have been obtained by such treatment, it has been but little used by pole consumers, except in certain parts of the South, where exceptionally rapid decay makes preservative treatment imperative. The chief hindrances to a more general adoption of creosote treatment for poles have been the high cost of the treatment and the expense of transporting the timber to a distant point for treating. The investigations of the Forest Service have, therefore, been concerned mostly with cheaper and simpler methods, and with treatments which could be applied locally without the erection of elaborate and expensive plants. Much attention has been given to the seasoning of poles, since proper seasoning not only prepares poles to receive the preservative treatment, but, under certain conditions, may be in itself a means of increasing their durability. The treating investigations proper have followed three general lines:

(1) Testing the efficiency of various wood preservatives and of applications of varying amounts.

(2) The developing of a method for impregnating the portion of a pole most subject to decay—the butt.

(3) Designing of inexpensive apparatus suited to the treatment of poles in small quantities, or in such quantities as local needs may require.

In these investigations much assistance has been received from a number of electrical companies, which have placed poles at the disposal of the Forest Serv-

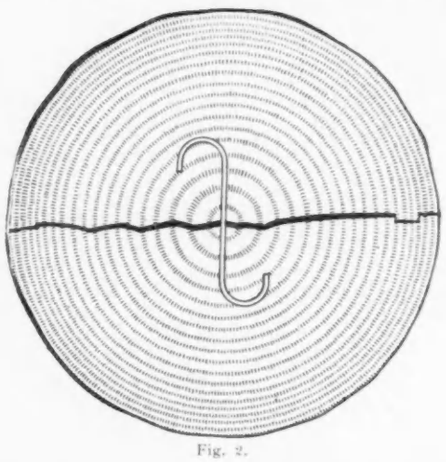

Fig. 2.

ice for the tests and contributed funds toward paying the cost of the investigations. The experimental poles, in most instances, have been placed in service by the companies interested, and in such a manner that durability records may be obtained from them. These records will prove a source of further information on the efficiency of the treatments.

RESUME OF PROJECTS.

In 1902 field investigations were begun in cooperation with the American Telephone and Telegraph Company. The project as finally developed included chestnut, southern white cedar, and northern white cedar poles, experiments with the first being conducted in North Carolina, New Jersey, Pennsylvania, and Maryland; with the second in North Carolina, and with the third in Michigan. Another project undertaken in co-operation with a number of pole-using companies in California included a study of the treatment of western yellow pine and western red cedar poles. Further sources of the information were afforded by treatments of lodgepole pine poles at a plant erected by the Forest Service on the Sopris National Forest at Norrie, Colo., and of loblolly pine poles at a plant designed by the Forest Service and erected by the North Louisiana Telephone Company at Winnfield, La. In addition to the tests in seasoning and treating, a number of experimental pole lines have been set, in which poles treated with various preservatives have been placed alongside of untreated ones in order that their durability might be compared.

RESULTS OF SEASONING TESTS.

Table 1 shows in round numbers the weight lost by poles during seasoning until approximately air-dry. After the weights shown in this table have been reached, loss of moisture does not cease, but may continue at a decreasing rate for many months.

TABLE 1.—WEIGHT LOST DURING SEASONING OF POLES UNTIL APPROXIMATELY AIR-DRY.

Species—	Duration of seasoning.	Green weight per cubic ft.	Seasoned weight per cubic ft.	Green weight lost.	Total weight lost per pole.	Nominal size of poles. Diameter.	Length.	Average volume of poles.
	Mths.	Lbs.	Lbs.	%	Lbs.	Ins.	Ft.	Cu. ft.
Chestnut	4- 8	56	47	16	180	7	30	20.00
Southern white cedar	3- 8	*a* 37	26	30	228	7	30	20.76
Northern white cedar	6-12	33	25	24	141	7	30	17.62
Western red cedar	3- 5	*b* 33	25	24	219	8	40	27.34
Western yellow pine	3- 9	65	33	49	835	8	40	26.10

a Weight on arriving at Wilmington, N. C., after rafting down the river.

b Approximate weight on arriving at southern California ports after transportation by boat from Puget Sound. Some of the shipments weighed more.

The limits of seasoning given in Table 1 are such as would be feasible in commercial practice, and indicate the weight poles must reach in order that the main bulk of the water which may be gotten rid of by air seasoning shall be evaporated. This means a loss ordinarily of from 16 to 30 per cent of the original weight, amounting to from 141 to 228 pounds per pole in these tests, and for western yellow pine the enormous loss of 49 per cent or 83 pounds per pole, occurred. Table 2 illustrates the saving in transportation charges possible through pole seasoning.

TABLE 2.—SAVING IN FREIGHT CHARGES AFFECTED BY SEASONING OF POLES. *a*

Species.	Seasoned poles required for minimum carload of 40,000 pounds.	Total decrease in weight due to seasoning.	Saving in freight on carload lots. 25-cent rate.	15-cent rate.
	Number.	Pourds.	Dollars.	Dollars.
Chestnut	43	7,700	19.25	11.55
Southern white cedar	74	16,900	42.25	25.35
Northern white cedar	91	12,800	32.00	19.20
Western red cedar	59	12,900	32.25	19.35
Western yellow pine	46	38,400	96.00	57.60

a Based on sizes and weights of poles given in Table 1.

The rate at which wood seasons is dependent on many factors, most important of which are climatic and seasonal conditions. Two poles of the same species and in the same locality, but cut at different times of the year, will require different periods of time to lose equal amounts of moisture. Table 3 shows in detail the time required for poles cut at different seasons of the year to reach the degree of dryness given in Table 1.

TABLE 3.—TIME REQUIRED FOR POLES CUT AT DIFFERENT PERIODS OF THE YEAR TO SEASON TO APPROXIMATELY AIR-DRY WEIGHT.

Species.	Location of test.	Time required for seasoning. Spring-cut. Months.	Summer-cut. Months.	Autumn-cut. Months.	Winter-cut. Months.
Chestnut	Parkton, Md.	5	4	8	7
Southern white cedar	Wilmington, N. C.	3	3	8	5
Northern white cedar	Escanaba, Mich.	12	9	7	6
Western red cedar	Wilmington, Cal.	*ab* 4	*a* 5	*a* 3	*a* 3
Western red cedar	Wilmington, Cal.	*c*(3)	*c*(6)	*c*(7)	*c*(4)
Western yellow pine	Madera Co., Cal.	5	3	9	6

a Period of seasoning computed from time poles arrived at Wilmington three to seven months after cutting.

b Weight of spring-cut poles at termination of test, 28 pounds per cubic foot.

c Period in storage and in transit, during which time little seasoning took place.

Poles cut during the spring and summer dry rapidly and, except in the case of white cedar in the latitude of northern Michigan, reach an approximately air-dry condition before the following winter. White

Fig. 3. Painting Butt of Telephone Pole With Spirittine, Wilmington, N. C.

cedar poles cut during the spring and summer did not become air-dry until the following year, and required more time than poles cut during the autumn and winter to reach an equal degree of dryness, the autumn-cut and winter-cut poles becoming dry by the following summer. However, during the early part of this experiment the poles lay on skids in the woods, where seasoning was retarded by lack of air circulation and sunshine, and by the swampy character of the soil. In February all poles, consisting of monthly cuts from April to December, inclusive, were removed to the Escanaba yard, where conditions were much more favorable to rapid seasoning.

The irregularities in the results of the western red cedar tests was caused by the long period the poles were in storage (in water) and in transit, piled solidly on the decks of vessels, little seasoning taking place during this period.

Besides climatic and seasonal conditions, many other factors affect the rate of drying out of poles, among which are the following:

(1) *Method of piling.*—In the tests the poles were spread out in single layers on skids, in which

form seasoning is most rapid. Seasoning will be much retarded if the poles are stacked in solid piles, and if that form of pile is used in a warm, moist climate, decay or injury by wood-boring insects is likely to follow should the poles be held for any considerable period.

(2) *Exposure.*—Seasoning is hastened by having the poles exposed to a free circulation of air. An open place free from underbrush or other rank growth should be chosen for the skidways. Shade does not seem to retard the loss of moisture, provided the circulation of air is not impeded.

(3) *Soaking.*—Poles that were soaked from two to four weeks in water dried out very rapidly and in a comparatively short time reached the same degree of dryness as other poles cut at the same time and not soaked. Thereafter the seasoning of both proceeded at practically the same rate.

While rapid seasoning makes it possible to realize the benefits of reduced transportation costs most quickly, it may be harmful in its effect on the timber itself. Poles seasoned rapidly check more than those seasoned slowly. Timber which seasons slowly and evenly forms numerous small checks, which close again when the wood absorbs moisture and which apparently have no detrimental effect. If, however, the poles season rapidly, wide and deep checks may be formed which do not again close, and which not only decrease the strength of the timber but materially hasten decay through the entrance of insects and fungi. Figure 3 shows the detrimental effect of checks that expose a very large surface to decay; they increase the rate of deterioration. Splits, windshake, and other defects of this character have a similar influence on the durability of the poles when the defects occur near the ground line.

Some species of wood, notably chestnut, have a tendency to form large checks or splits; in some cases the split opened a foot wide and extended 9 feet upward on the pole. By the use of S irons at the first indication of a tendency to such checking, serious damage may be avoided. These may be made of strap iron one-eighth inch by 1 inch, bent in the form of a letter S, from 3 to 6 inches long, and driven into the butt of the pole as shown in Fig. 4.

Hundreds of careful measurements show that the amount of shrinkage which takes place during the seasoning of poles is very slight, though this is contrary to the opinion of pole producers and consumers. The amount of shrinkage in seasoning from green to air-dry condition averaged from 0.3 to 0.5 per cent on the circumference at the ground line (6 feet from the butt), and from 0.6 to almost 1 per cent at the top. On the sizes of poles more commonly used this is equivalent to about 0.1 or 0.2 of an inch in the circumference of the butt and from 0.15 to 0.25 of an inch on the top.

BRUSH METHOD OF TREATING POLES.

A very simple method of using a preservative consists in applying it to the surface of the wood with a brush. Fig 5. There are several patented or proprietary preservatives intended for use in this manner. While the experiments show good results from surface applications of antiseptic oils, this form of treatment does not present a complete solution of the question of pole preservation.

A brush method of treatment has the advantage of very low cost, owing to the small amount of preservative used and to the fact that no special treating apparatus is required. It is especially useful where the number of poles is small, or the region remote, so that the erection of even the most simple form of treating plant would not be justified. In the experiments, a penetration of from one-eighth to one-fourth inch was obtained in seasoned timber. Table 4 shows the amounts of preservative absorbed in a number of tests. The absorption was ascertained by weighing the vessel containing the preservative before and after each treatment, the difference in weight being taken as the amount absorbed by the pole. In all cases the preservative was applied hot.

Table 4.—Average Absorption of Creosote Resulting From the Brush Method of Treatment.

Species.	Locality.	Absorption per pole. 1 coat.	2 coats.	Length of pole.	Length treated.	Number of poles averaged.
		Pounds.	Pounds.	Feet.	Feet.	
Chestnut	Parkton, Md.	2.6	4.7	30	*a* 6	92
Southern white cedar.	Wilmington, N. C	...	4.9	30	*a* 6	50
Northern white cedar.	Escanaba, Mich.	3.0	4.4	30	*a* 6	98
Western red cedar....	Los Angeles and Wilmington, Cal	...	6.5	40	*b* 8	75
Western yelow pine...	Pollasky, Cal...	2.4	3.6	40	*b* 7	32

a Between 2-foot and 8-foot points on butt. *b* From butt to height indicated.

Much care should be exercised to fill or coal all season checks with the preservative, for unless this is done the treatment is likely to prove in effective, because decay will get a foothold in these checks. Only poles which are thoroughly seasoned should be treated and the preservative should not be applied when the surface of the wood is wet, as after a rain, or when very cold. In most cases, better results will be obtained by heating the preservative before applying. Bits of bark adhering to the poles should be carefully removed. Even if the treatment is apparently well done, decay may get a start in the untreated portion underneath the protecting layer of treated wood.

Fig. 4. Treating Tanks at Thorndale, Pa.

OPEN-TANK PROCESS OF TREATING POLES.

The open-tank process of timber treating consists in subjecting the timber to successive baths of hot and cold preservatives (Fig. 6). In this way atmospheric pressure is used to accomplish to a large

As a rough approximation of the quantity of preservative required for pole treatments, 1 gallon may be allowed for each 25 square feet of surface to be covered, when two coats are applied.

extent what is more commonly accomplished by artificial pressure. The open-tank or nonpressure method, like the brush method already described, has the advantage that the preservative may be applied to the butt of the pole only, and this avoids the expense of applying it to the portion above ground, which in many cases is sufficiently durable without treatment. The efficiency of the method as regards the first object of the treatment, the impregnation of the wood, is

Fig. 5. Round Electric Light Pole, Creosoted. Money Point, Va.

Fig. 6. Typical Decay in Untreated Cedar Pole, Near Savannah, Ga.

Table 5.—Average absorption and penetration of creosote obtained in the butt treatment of poles by the open-tank method. Species.

	Absorption per pole. Pounds.	Penetration. Inches.
Chestnut	21.5	0.3
Northern white cedar	48.4	.5
Western red cedar	39.5	.8
Western yellow pine	81.4	3.1
Lodgepole pine	34.0	1.0

shown in Table 5. These figures represent typical results obtained in treatments.

In the open-tank process the impregnation is accomplished by subjecting the timber to a change in temperature, by means of a hot followed by a cooler bath. Any one of three general methods may be followed to accomplish this result: (1) After the timber has been held in the hot preservative for the required length of time, the heating may cease and without other change the whole be allowed to cool; (2) the timber may be transferred from the hot liquid to another tank containing cooler preservative; (3) the preservative may be changed, the hot being drawn off and colder preservative run into the treating tank. The three methods of procedure indicate in a general way the different types of apparatus which may be used in the treatments.

While it is desirable, in commercial practice, to give the treatment in the shortest time possible, the fact should not be overlooked that the open-tank process of treatment is an impregnation process, and differs radically from a mere dipping process, or a coating of the surface with preservatives. It is therefore not advisable to reduce the length of the treatment to such an extent as to risk impairing its efficiency.

The time necessary to secure any desired penetration or absorption will vary with the species, the moisture condition of the timber, and many other factors, and must be determined by actual test in each case. Some species have a comparatively narrow sapwood, and a heartwood which it is difficult or impossible to penetrate; with such species it is useless to prolong the treatment after the sapwood has been penetrated. Other species, among which are loblolly and western yellow pines, have wide sapwood and treat very easily, and with these it is necessary to regulate the treating period so as to avoid an unnecessarily large absorption of the preservative.

Except in the case of very dry and porous woods, the absorption takes place mostly during the cooling process. The function of the hot bath is to prepare the wood for treatment. The drier the wood, the shorter the period of the hot bath needed. A long period in the cold bath, allowing the preservative to cool to atmospheric temperature, gives a saturated absorption. Shortening the cold bath and removing the timber while the preservative is still fairly hot gives a relatively deep penetration as compared with the quantity of preservative absorbed. This consideration is of especial value in treating porous wood.

In most of the experiments the hot bath was given at a temperature slightly above the boiling point of water, that is, from 215° to 230° F. There are a number of advantages in using a high temperature, and it is especially necessary if timber is not thoroughly air-dry. However, a number of successful treatments were made with temperatures of 200° and less.

Among trees of the same species, those having wide annual rings commonly have wider sapwood than those whose growth has been less rapid, and since in many species it is only the sapwood that is penetrated, it follows that the pole of rapid growth will absorb more preservative than the one of slow growth. Chestnut poles showing a maximum growth of 2 rings to the inch absorbed the preservative to a depth of 0.75 of an inch, while others having 15 annual rings to the inch received a penetration of only 0.2 of an inch. The penetration in the case of northern white cedar poles averaged 0.6 of an inch for poles with less than 20 rings to the inch and 0.4 of an inch for those having more than 40 rings to the inch.

It is probable that the variation in wood structure due to difference in rate of growth, aside from the relative amounts of heartwood and sapwood, affects the absorption and penetration of preservative, but there is no conclusive evidence on this point.

In general, the drier the wood the more readily it may be treated. Poles thoroughly air-seasoned require less time for treatment than those only partially seasoned. The treatment of green timber is unsatisfactory because of the small absorption and irregular penetration of the preservative. Another important reason why unseasoned poles should not be treated is that such poles are likely to check in drying, and thus expose untreated wood decay.

In the experiments with western yellow pine, poles cut in different seasons of the year differed greatly in the ease with which they absorbed the preservative.

the summer-cut poles absorbing less than those cut at any other season. This difference in absorptive qualities may have been due to rate of seasoning and rate and conditions of growth, rather than to inherent differences in the wood due to the time of cutting. It is known that absorption may be retarded by "case hardening" that may result from too rapid drying. Tests on chestnut show that poles having the same moisture content, although they were cut at different periods of the year, absorb the same quantities of preservative.

Chestnut poles which had been soaked in water two weeks and then seasoned did not absorb any more creosote than poles that had not been soaked. Soaking in water is rarely justified as a means of making wood more permeable to preservatives.

ADVANTAGES AND LIMITATIONS OF THE OPEN-TANK PROCESS.

The open-tank process is not adapted to the treatment of woods which are difficult to impregnate, nor to unseasoned or partially seasoned wood, and as regards economy of operation has not justified itself in plants designed for the treatment of the entire pole. The large amount of oil lost by volatilization from open tanks and the difficulty of accurately gaging and regulating the amount absorbed are other disadvantages. (*To be concluded.*)

Telephone Report in England

As is perhaps well known, there are in general two telephone systems in England—the National Telephone Company, which is a private corporation, and a system operated by the Post Office Department. It is the intention to have the Post Office take entire control of the telephone system, which they will do at the expiration of the license under which the National is working. The last report of the British postmaster general gives some valuable information regarding the extent of telephone usage in England.

The total number of telephone trunk line exchanges open at March 31, 1911, was 678, compared with 643 at March 31, 1910. The capital expenditure at the same dates was $25,887,970 and $24,514,675 respectively; the number of conversations over inland trunk lines 30,100,068 and 26,566,318 respectively; the average payment per conversation 12.2 cents, as against 11.9 cents; the gross revenue from inland calls $3,711,618 as compared with $3,214,800; and the receipts from calls from continental Europe $119,630 as compared with $117,055. During the year 137 post office telephone exchanges were opened in the provinces—97 in England and Wales, 24 in Scotland and 16 in Ireland. Of these 40 were opened under guarantee terms under which the state bears two-thirds of any loss on the expenses of working. The approaching expiration of the license of the National Telephone Company has thrown the work of extending the telephone system to the less populous parts of the country more and more on the post office. As was pointed out last year, such extensions, though they are of great value to the districts concerned, yield no direct profit for some time, and in some cases cause a loss. The great majority of the post office provincial exchanges are of this class, so that a favorable balance-sheet cannot be expected until the company's business in more profitable districts is taken over. There are nevertheless no grounds for doubting that judicious extension, rendering the previously existing provincial system more valuable to the users and more profitable to the state, is a sound policy. The National Telephone Company is, at the cost of the post office, proceeding with extensions in outlying parts of certain areas served by their system.

The question of introducing a cheaper form of telephone service in sparsely populated rural districts is under consideration. Besides the 137 exchanges above referred to, 42 public call offices, with full facilities for speaking over local and trunk lines, were opened at small places where the number of prospective subscribers was not sufficient to warrant the opening of exchanges; and 25 call offices with limited facilities were also opened in various country districts.

The total number of lines directly connected with the post office provincial telephone exchanges on March 31, 1911, was 28,441, as compared with 26,112 on March 31, 1910, and the number of exchange telephones increased from 33,330 to 36,650.

In May a new four-wire telephone cable was laid across the Straits of Dover between Abbot's Cliff and Cape Grisnez. This is the first commercial use of a submarine cable fitted with inductance or loading coils, which are designed to minimize the attenuation and distortion of speech transmitted through the cable. An agreement has been entered into to provide a similar cable for the Anglo-Belgian telephone service.

The question of the rates of subscription for exchange service has attracted considerable public attention during the past year, and a deputation on the subject at the House of Commons were informed that no change in the present rates would be proposed until after the Railway and Canal Commissioners have given an award as to the price to be paid for the National Telephone Company's plant and assets.

The following estimated figures show the extent to which the telephone is being used for sending messages for onward transmission as telegrams and express letters: Telegrams 5,372,000, an increase over 1909-10 of 9-1 per cent; express letters 196,000, an increase of 20 per cent. The number of messages sent to the post office by telephone for onward transmission as ordinary letters decreased from 3,200 to 3,100, while the telegrams delivered during the year to addresses by telephone numbered 2,447,000, as against 2,154,000 in 1909-10. The number of telegrams delivered by telephone represented 3 per cent of the total number of telegrams delivered. There is a considerable demand for wires in connection with fire-alarm systems, the electrical regulation of clocks, telewriter installations, etc.

Telephones in Korea

On March 31, 1910, the number of post offices in Korea was reported as 438, of which 293 dealt with parcels, 290 were postal savings banks, 259 were telegraph stations, and 73 were telephone exchanges. Their ordinary revenue was $998,488, and their ordinary expenditure was $1,059,042. The deficit and an extraordinary expenditure for extension and repair, amounting to $151,172, were defrayed from the imperial treasury of Japan. Postal routes covered 19,347 miles; telegraph routes covered 3,360 miles, with 7,625 miles of wire; telephone wires measured 3,193 miles.

A Telephonic Canvass for Votes

By Warren H. James

TELEPHONING for votes on a public bond issue, and getting them, is rather an unusual enterprise. In fact, it is claimed by the Missouri and Kansas Telephone Company's exchange at Carrollton, Mo., to be an entirely new use for the telephone.

Last January, while the legislature was in session, the Missouri state capitol at Jefferson City, burned—a total loss. In the emergency the legislature passed a bill authorizing a bond issue of $3,500,000 for the rebuilding of the capitol as soon as arrangements could be completed. These arrangements contemplated submitting the question of the bond issue to a vote of the people of the state of Missouri at an election to be held August 2.

When the bill calling the special election for the new capitol came up for passage, Senator William G. Busby refused to support it in the senate until the commercial club of Jefferson City would secure written options from the property owners in the block lying immediately south of the old capitol site, stating in advance the amounts which they would take for their property in case the people should vote for the new capitol, with the result that all the property owners filed the options with the secretary of state, fixing the total amount to be paid at one hundred eighty thousand dollars before the passage of the bill in the senate. It was later announced, as was foreseen by Senator Busby, that this block would be added by the state to the old capitol site so that the new capitol building could be erected further south from the river and railroad tracks, and as the written options limited the amounts to be paid for the property to reasonable prices, they doubtless saved the people of the state thousands of dollars in the purchase of the property. Had it not been for these options, in all probability the proposition would have been defeated, as there was an effort made by the enemies of the proposition to make it appear as a real estate scheme on the part of the property owners of this block.

F. E. Lovell has been district manager of the Missouri and Kansas Telephone Company at Carrollton, for a good many years. His business makes it necessary for him to travel over about one-third of central Missouri. In this territory, and on the itinerary of Mr. Lovell's periodical trips, is Jefferson City, the state capital. In the course of several years of this work, it is but natural that the district manager should not only become acquainted with state officials, but should acquire also a keen insight into the political conditions of the state and the public attitude toward those conditions.

So it happened that in July, just before the election on the bond issue, Mr. Lovell was in Jefferson City. His friends, the state officials at the capital, took occasion to inquire of him what the results would likely be of the election. Mr. Lovell was able, through his knowledge of state-wide conditions and public attitude, to inform them that the people were showing little interest in the event, for there were no persons to be voted on, and the bond issue itself would scarcely bring out a large percentage of the vote. The state officials were very much interested, of course, in the success of the bond issue, and were a unit in believing that if there was some way of calling the people's attention to it there could be no doubt of its carrying.

Mr. Lovell, accordingly, put some thought on the matter, and a year-old incident occurred to him which, though it could hardly be called a precedent in the case, indicated the power of the telephone to convey special information to the people in a way calculated to impress them more forcibly than would the ordinary line of printed circulars or letters.

It happened that a theatrical company, playing at the Willis Wood theater (the best theater in Kansas City), had lost one of its dates by reason of the fact that a theater at some point on its route had burned. To fill in its itinerary the theatrical company had brought its people and paraphernalia to Carrollton, wholly unannounced and unadvertised.

Now, Carrollton is a town of some 3,500 population; not a particularly promising theatrical stand without a considerable amount of "advance" work—which means billposting, press notices, and any other available means of letting the public know of its presence.

So the manager of the theatrical company called at Mr. Lovell's office in the Carrollton telephone building and stated the facts. His idea was to arrange with the telephone company to have its operators say something about the theatrical performance of that night to every subscriber who called in for a telephone connection between the hours of 11:00 A. M. and 1:00 P. M. He was confident that if he could consummate this scheme he would sell to standing room at $1.50 per seat—which is a very high price for a town the size of Carrollton. To shorten the story of this incident, the persistence of the theatrical manager finally won, and Mr. Lovell consented to the arrangement, with the result that the showman's anticipations were fully realized and he hung out the "S. R. O." sign that night.

With this success in mind, Mr. Lovell was inclined to believe that something might be done in the way of interesting telephone subscribers and users in the state capitol bond issue. The fact that the project was truly meritorious, and, in spite of its official nature, entirely devoid of political aspect, encouraged him to outline a plan of action, which he laid before the state officials and politicians of Jefferson City. The arrangement was that a large number of them should meet him at Kansas City and go to the president of the telephone company for permission to arrange for the use of the telephone generally over the entire state, including Kansas City, St. Louis, Springfield and the smaller towns. Mr. Lovell had good reasons to believe they would be successful in their plans.

The president agreed readily. Indeed, he went further. His interest was aroused, and determined that anything to which the telephone company lent its aid and assistance should be done right, with no chance of failure, he went out of his way to promote the success of the undertaking.

The original plan had been to have the operators

at Kansas City and St. Louis call the subscribers and mention the bond issue election, just as they had mentioned the theatrical performance at Carrollton. Instead of this, the telephone company furnished 25 operators and installed 25 telephones in one of the large rooms of the telephone building. With the assistance of the Missouri state officials the poll books of Kansas City and St. Louis were secured and the voters called one by one—or perhaps it were better to say twenty-five by twenty-five. This system of calling was started two days before the election and kept up until a short time before the polls were closed, those who had been reached being checked off the list. And in the smaller towns all over the state the telephone company and, at its request, the connecting companies, had their operators begin early on August 2, the day of the election, to remind every subscriber not to forget to vote for the state capitol bond issue. The Kinlock (St. Louis) and Kansas City Home Telephone Companies, both independent, took the plan up also, as well as their connecting companies.

The bond issue for the new Missouri capitol passed. That the extraordinary use of the telephone in canvassing for votes on the proposition had a great deal to do with it is indicated by an editorial in the Jefferson City *Republican-Record*. After praising the efforts of State Senator Busby, the editorial says:

> Another Carrolltonian who contributed largely to the success of the proposition was F. E. Lovell, district manager of the Missouri and Kansas Telephone Company. A short time before the election he was in Jefferson City and suggested to the managers of the capitol rebuilding committee that the telephone be used to get out the vote on election day. His suggestion led to the matter being taken up with the managers of the telephone company at Kansas City, with the result that extra operators were furnished for that purpose in the large cities of the state on election day, while in the smaller towns of the state the operators were instructed to remind every voter when he called a number to go and vote for the capitol bonds. This resulted in getting out a much larger vote than would otherwise have been polled, and no doubt did more good than all of the campaigning that had been done by the committee. Hence we say without fear of contradiction that to Senator Busby and Mr. Lovell is due a great deal of credit for the success of the capitol proposition.

And in crediting Mr. Lovell it should not be forgotten that to the telephone itself—the only practical means of reaching so many people so quickly and effectively—is due the appreciation of those whose public spirited projects were successfully culminated by its use.

Telephones in Russia

The latest available data show that the gross receipts of the Russian postal, telegraph and telephone services, exclusive of Finland, aggregated $41,358,500 in 1908, an increase of $1,656,042 over the previous year. The largest portion of the receipts was derived from the postal service and amounted to $26,928,458.

The expenditures amounted to $25,926,265, an increase of $1,878,357 compared with previous 12 months. This considerable increase was due principally to the larger allotment toward an increase in the staff, and in the prevailing wages of post and telegraph employes, as well as appropriations toward the extension of the telegraph and telephone system. Thus the government derived a net profit of $15,422,295 from its postal, telegraph and telephone services, which represents nearly 60 per cent of the total investment in this department.

The telephone service in Russia is maintained partly by the government and partly by private companies. The zemstvos are also exploiting the telephone service in 69 counties. The government maintained 99 urban telephone lines, 4 long distance lines, namely, St. Petersburg-Moscow, Warsaw-Lodz, Rostov-on-Don-Taganrog, and Minsk-Novo Borissov. Besides this a telephone service was carried on between 30 cities by means of telegraph lines for the purpose of transmitting telegrams.

The receipts from the government's telephone system amounted to $1,370,855 and the expenditures to $774,393, yielding a profit of $596,462. A telephone service was also maintained in 55 cities by private companies and the government's revenue, derived by means of a tax of 3 per cent levied upon the gross income of these companies, yielded $77,466.

Ohio Commission News

The Mount Sterling, Ohio, and the Bell telephone companies have applied to the Public Service Commission of Ohio for permission to connect their lines. At the hearing of the case before the Commission, R. H. Schryver, secretary of the former company, stated that his company had a ninety-nine year contract with the United States Telephone Company for the exclusive right to all the long-distance business passing through the exchange, but that the company had consented to the installation of the Bell wires as competitors. The fact was brought out that the same conditions exist regarding the Van Wert Telephone Company, where the Bell lines are also seeking connection. It is claimed by those opposed to this action that both the Bell and United States companies are owned by the same interests, who have simply been waiting for legislation which would permit their consolidation.

Under the new law it is not necessary to place specific instances of poor telephone service before the Public Service Commission in order to have an investigation made by that body, but it may make the investigation upon any form of complaint or upon its own initiative without any complaint whatever.

It has been intimated that the constitutionality of the new public utilities law might be tested on the ground that it implies the taking of property without due process of law. No provision is made for notifying public service companies when an appeal for a lower rate has been filed, when such reduction might result in loss to the company.

Ohio Companies Can Raise Rates

Telephone companies may increase their rates whenever they see fit, according to an opinion rendered by Secretary Radcliffe, of the Ohio public service commission, in contradicting the impression obtained by officials of several phone companies that the new public utilities law forbid any increase. The companies are only compelled to file their new rates, the secretary explained, and the commission may investigate rates upon complaint or its own initiative, and lower them if it is found that they are unreasonable.

Who's Who in the Telephone Game

Facts and Fancies About a Man You Know or Ought to Know

WHAT wots it if steel is all shot to pieces? If it had had engineers to look after its inside construction outside and outside construction inside; had had proper insulation; self-soldering fuse joints; proper type wire-connections; efficient terminals and pot heads, it would be a few hundred millions to the good. Such trouble always follows carelessness respecting details.

Along came the telephone in 1876 and along came a man in its wake who saw nothing half so important as its protection both inside and outside. He knew that the dainty little currents would require safeguarding from a thousand angles and he got busy right away looking out for them. This young man wore rubber boots and a gum coat. It was before the time of rubber heels and gum shoes. He wasn't very tall and he didn't carry much flesh. His face was almost colorless and his hair nearly white. He was high-strung to the point of getting on your nerves because he was bent on following the pussy-footed wave currents that had been harnessed for speech transmission. He wanted to help it through brick walls, and around cornices and save it from being tangled up with the more boisterous currents, both natural and artificial. Then it had to be helped up and down the poles and into and out of basements. He didn't want it to freeze up in winter or melt in summer. As a matter of fact this man wanted to be the day and night chaperone of telephone circuits which were then threatening to mix with a complicated mess of other rude and noisy ones.

They Would Guess Missouri, Nine Out of Ten.

The man with these ideals didn't know a great deal about electricity. His father was a contractor, going in for big bridge construction and there was no time for school and no school for the fellow who had time to go. So these lofty ambitions came from a mechanic—his father's best helper, because he was thorough and highly efficient in solving the hard problems.

But boys grow to maturity after a while and the age of twenty-one used to be the fashionable, if not the exact moment when they started for themselves. It was in 1876 that this man reached his maturity in years, broke away from bridge building and engaged in telegraph work. He didn't go in for operating. He was for the construction work; the fitting up; the wiring; the fool-proofing of the equipment for the man at the key. A couple of years later he drifted into the telephone game. This new work contemplated the assembling and testing of telephone lines for Wm. Kleine, superintendent of telegraph of the Lake Shore & Michigan Southern Railway, which might suggest that the Lake Shore took hold of telephones when they were very young.

Those people who know Frank B. Cook will be surprised to learn that he was born in Michigan. They would guess Missouri, nine out of ten. Not that he looks or acts like a Missourian—not that, but they know that he can't be led, pushed, crowded or shoved. He has always been that way. He runs his own business and does things in a business-like way. He is willing to be shown, but you must be sure to do that. Cook proves and patents his stuff—remember that. He don't bank very heavily on your willingness to show unless you skin off the covering and fetch along an X-ray machine. It is an awful mistake to suggest that Mr. Cook should or should not do it. He always has a mind of his own—a business of his own. And what is his business is very apt not to be any of yours.

Well, anyhow, he settled down to a regular career in telephone work on June 15, 1879, associating himself with the Toledo Telephone Exchange Company at Toledo. The concern was afterwards absorbed by the Central Union Telephone Company, of which you may have heard. Frank B. broke into the game as foreman of construction, with a side assignment to invent something every day. The invention was to be his property—his services belonged to his employer. By gradual development he served in all the various departments and finally reached the position of chief engineer, having charge of all inside and outside construction, apparatus and equipment. The company had about two hundred exchanges and was spread out all over Ohio, Indiana and Illinois, and lopped over into Iowa, when in 1896, Frank B. hired a dray to move his accumulated patent applications and models, resigned, and came to Chicago to embark in

manufacturing pertaining to the telephone business.

Mr. Cook's inventions are many and varied, but they hold pretty closely to telephone protective apparatus. His stuff is known around the world and his name is burned into every piece of it. You can't get very far into telephone equipment without coming face to face with something from Cook's works. You've just got to have it. It is as necessary as films are to a moving picture show, and it is good, dependable stuff, bearing a man's name who devised it, made it, and then filed his name into it.

Frank B. Cook was born October 18, 1855. His birthplace was Monroe, Michigan. He had the benefits of early school training, but his real education came from experience. Of late, he has developed an acute taste for travel. He has only recently returned from an extensive trip abroad where he busied himself with seeing things that other men had made. He was accompanied by Mrs. Cook and it is reported that no book will issue to chronicle "How the Cook's Saw Europe." It was a trip for fun and that's what it proved.

Mr. Cook is a member of the Chicago Automobile Club, and his chief recreation is found in driving his own car. His social activities are largely confined to his home and near personal friends. His middle name? Oh, you had thought it was only B? That's only his trade-mark, incorporated. Frank B. Cook is Frank Brazil Cook—Brazil coming to him from fourteen generations back.

Cathode Rays in Telephotography

Cathode rays are deviated by a magnet instantaneously, says a writer in *La Nature*. This fact has been utilized by Dieckmann and Clage in the construction of a telephotographic receiver destitute of inertia. A pencil of cathode rays is defined by a diaphragm having a fine perforation. This pencil is acted upon by two pairs of electro magnets which displace it in two mutually perpendicular directions, and which are operated by two current components determined by the movement of a stylus at the transmitting station. The result is that the pencil of cathode rays imitates every movement of the stylus instantaneously and thus produces, in a plate of chalk or other fluorescent material, a luminosity which appears to the eye as a continuous line comprising all the successive position of the luminous point. In the construction of the transmitter an artifice which has long been used in telautography is employed to resolve the motion of the stylus into rectangular components and to translate these into current strengths.

The following modification of the process has a certain practical importance. The electro magnets, operated by a small dynamo provided with a voltage regulator, are so arranged that they throw the pencil of cathode rays into regular oscillation in a vertical plane. Each vertical oscillation is followed by a small horizontal displacement, so that the phosphorescent point describes a series of parallel lines very close together. In this way the phosphorescent point explores, in about 1-10th second, an area three centimeters (1.2 inches) square. In consequence of the persistence of impressions on the retina, the entire square appears luminous. The transmitter contains a square of the same size, which is explored successively by little metallic brushes in synchronism with the receiver. These brushes are connected to one pole of a battery, the other pole of which is connected through the line wire to two coils which serve to deflect the cathode rays at the receiving station. The other ends of these coils are grounded. A pattern or stencil of sheet metal, connected to earth, is laid on the transmitting square beneath the little brushes which as they traverse every part of the pattern, close the circuit, so long as they rest upon the metallic portions. When the circuit is closed, the cathode pencil is deflected, so that it does not fall upon the receiving screen, consequently the phosphorescent point traces on the screen only those areas which correspond with the cut-out portions of the stencil. The whole operation is repeated indefinitely and consequently the picture can be viewed as long as desired. With this arrangement each element of the image is produced in 1-5,000th second. The inventors of this process intend, if possible, to utilize aerial electric waves for transmission, in order to eliminate perturbations due to conductors.

Drama Founded on the Telephone

Rehearsals of William C. de Mille's new play, "The Woman," which David Belasco will produce in Washington on Easter Monday, began recently and for the first time the members of the cast learned that the heroine is a telephone girl and that the action of the piece is unique in that it revolves around the telephone.

In the three acts of the play Mr. de Mille essays to show how the telephone dominates and controls the destinies of men and women and of cities and nations. Wanda Kelly, the telephone girl of the play, explains the theme in this manner:

"One of the big central telephone stations is the world—all boiled down and spread out on the switchboard and right there on that board thousands of people are meeting, their thoughts are crossing each other—and the Hello Girl is perched on the top of a high mountain, looking at them. That's the real world—what people are thinking—and it's all on the board, good and bad, winners and losers, rich and poor, all mixed up together, all going on at once. And the operator is a sort of Fate who sees that the right people get each other, and—like Fate—she has to let them work out their own affairs, though she could often save a lot of trouble if she mixed in. I tell you it's hard not to interfere sometimes when you've got the whole world under your two hands."

Telephones in Uruguay

Consul Frederic W. Godnig, Montevideo, states that the two telephone companies in Montevideo have 16,654 miles of wire in use in the city and 1,040 miles in the country. The telephones in use number 8,150, with 33 branch offices and 55 toll stations.

The telegraph companies use their lines for both telegraph and telephone messages. Other than the above there are several short private telephone lines in various parts of Uruguay, data of which can not be obtained.

The government is considering the construction of a modern underground telephone system, and has completed the survey and estimates. It is only a question of time when the telephone in Uruguay will be owned by the Uruguayan government.

Some Questions Answered

By J. C. Slippy

[This department is at the command of our readers. Questions relating to all branches of telephony—technical, financial, ethical, or otherwise—are invited, and will be answered in the order received. Answers by mail, if requested. Names of inquirers will not be used unless desired.—*Editor.*]

GROUNDED COMMON RETURN.

Would you please be so kind as to give me a bit of advice on the following? Our exchange is what is called the grounded circuit, and we are going to put some of the telephones on a common return system, using No. 14 line wire and No. 10 copper for the return.

Now, what I wish to know is this: Should the return wire be grounded at the station to the other ground wire or not? Or should the return wire be independent from the grounded

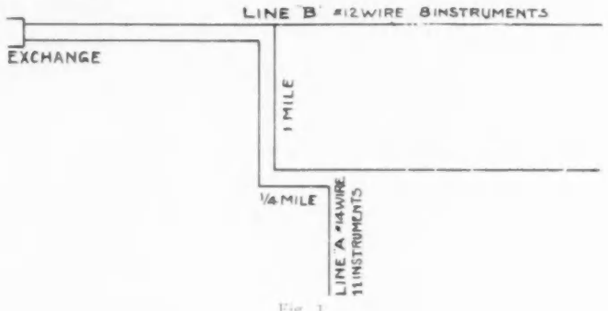

Fig. 1.

circuit? Some tell us it should be grounded and others say not.—A. H. D.

Please answer through your "question and answer" department in your next issue the following: Is it necessary to run a common return wire through the ground (ground common return and ground switchboard connection)? Cannot the common return be connected direct to the board?—F. W. V.

The question whether the common return wire should be grounded at the central office or completely insulated have been points over which many a telephonic battle has been fought. To ground the common return at the office might seem to invite disturbance. That in some cases the ground is an injury is unquestioned, but in other cases the conditions are such that a ground at the office will materially tend to quiet subscriber's lines, and it is impossible, theoretically, to say whether a given common return system should or should not be grounded. For example, in a poorly insulated wire plant some lines may leak foreign current into the system that in an endeavor to find an outlet will distribute itself over all lines. A ground at the office will afford the desired relief, and while such an expedient will increase the noise on

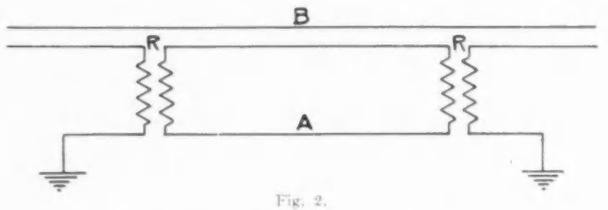

Fig. 2.

some poor lines, it may render a great many others satisfactorily quiet. As the matter is so easily demonstrated by experiment, those who are operating a common return can easily test it for themselves, by applying and removing ground either at the office or at other points of the line and determining under what conditions the most satisfactory service is obtained.

PARTY LINE TROUBLE.

We have two-party lines with grounded circuit as per diagram (Fig. 1), and are troubled with cross-talk and bell-ringing at times. Line "A" is No. 14 B. B. telephone wire and has 11 telephones. Line "B" is No. 12 soft steel wire and has eight telephones. The wires are on the same poles for a distance of about 10 miles. Can you tell us how to overcome this trouble?—J. W. B.

The most effective method of clearing your trouble would be to make one line a metallic circuit for the distance it is parallel to the other line. The two ends of the grounded line may be connected with the intermediate portion by means of the repeating coils *RR*, as shown in Fig. 2. By this arrangement no disturbing effect is produced on either line if proper precautions are taken in the way of transposing the two sides of the metallic circuit.

PRIMARY BATTERIES.

Please give the following information about primary batteries for local battery telephones: With the average amount of use, how long will the following batteries give service, and what is the voltage of each?

Dry battery (average).
Fuller battery.
Gravity battery.
Edison battery (Type R. R. or other type).—W. F. C.

Abbott gives the following data on the above types of cells:

	Mean working E. M. F. volts	Average internal resistance ohms	Maximum delivery current amperes	Capacity in ampere hours	Continuous current amperes
Fuller	1.8	0.40	4.50	68	...
Gravity	1.0	6.5	2.0	20*	...
Edison R. R.	0.667	0.043	15.511	300	4.0
Dry cell—average	1.55	...	...	30*	...

*Estimated.

SYSTEM OF TRANSPOSITIONS.

Through your "Questions Answered" column, will you please state which is the better practice in this little difference of opinion and give reasons why your opinion is correct? We have a branch line about 27 miles long with a trolley wire the whole length and feeder about 15 miles of that length. High tension at 22,000 volts extends along the line about 19 miles from one end. Most of the distance the telephone line is carried on separate poles from the main line, about 30 feet from the high tension, and at other points it is about 50 feet away, while at others it is carried on the main line poles for short distances about 10 feet below the lower wires of the high tension. The road was originally steam and the telephone wires were transposed about every half mile, say 20 poles. When the line was changed to electricity, "A" went over the telephone line, transposing it every four poles, running transposition (single insulator), and transposing the wires first clockwise and then counter-clockwise in order to avoid cutting the wires, as would need to be done if all the transpositions were made clockwise. Where it was necessary to cut the wires to pull up slack, McIntyre sleeves were used. Then there were some changes made and "B," claiming that "back transpositions," as he called the counter-clockwise ones, hurt the line, had them all taken out and also the McIntyre sleeves, so that now the transpositions are all clockwise. Some of the joints are three-wire and some Western Union, but none are soldered. The wire is No. 9 galvanized iron. "B" also claimed the transpositions were too close together and had them put 10 poles apart. In order to make all transpositions in the same direction, he cut two joints in each wire at every other transposition that "A" had put in.

As nearly as you can tell from this description, which one, "A" or "B," had the line in the better shape and why? If there is any additional data you wish, please let me know.—H. A. F.

From your description we judge that "A" had the line in better shape, as a high tension line of 22,000 volts would require transpositions to be placed in the telephone line at very short intervals. As to whether the transpositions should be "clockwise" or "counter-clockwise," the theory of the transposition is simply to cause each half of each circuit to frequently interchange position with reference to all other neighboring circuits. Any scheme which will produce this result is satisfactory.

Telephone Pioneers of America

THE pioneers in the introduction of the telephone in America are to have a reunion, the first assemblage of the kind ever held, and it is to take place in Boston Nov. 2, 3 and 4.

Prof. Alexander Graham Bell, who invented the telephone nearly forty years ago and who is still hale and hearty, is to preside at the sessions, and among the other veterans of the service present will be Charles J. Glidden of Boston, of automobile touring and aviation meet fame, who claimed the distinction of having obtained at Lowell the first telephone subscriber.

The spirit with which the operation of the telephone was first received in this country is well illustrated by extracts from the Manchester Union in 1877, at which period the earliest public demonstrations of the invention were made in this vicinity.

One article from the Union, dated May 9, begins with the statement that "In this age the world seems disposed not to show either surprise in or enthusiasm for anything new," and it then says that though the public had been notified by advance announcement of the workings of a new invention, the telephone, the hall where the exhibition took place in Manchester contained hardly 400 persons.

The following list gives the membership of the Telephone Pioneers of America at present. The name of each member is followed by the date at which he entered telephone work:

E. W. Abbott, January, 1884; William Rufus Abbott, March 1, 1889; Daniel M. Adee, June, 1878; W. H. Adkins, 1878; C. H. Adler, April 1, 1878; A. M. Allen, February 1, 1880; H. E. Allen, May, 1885; Albert P. Allen, August, 1890; C. D. Avis, June 30, 1890.

W. H. Badour, May, 1884; Thomas B. Bailey, February 28, 1878; Ellis B. Baker, January 31, 1878; Hugh C. Baker, October 18, 1877; K. S. Baker, April 22, 1882; P. K. Baker, 1885; Wm. H. Baker, July, 1886; C. R. Bangs, November 1, 1888; Edward H. Bangs, January 9, 1888; A. Barrett, May 1, 1883; John A. Barrett, July, 1881; J. H. Barry, April 30, 1884; Enos M. Barton, 1876; H. G. Bates, 1884; E. E. Bawsel, February 6, 1878; M. S. Baxter, April, 1879; James Beamer, May 1, 1881; F. E. Bedlow, July 18, 1887; Alexander Graham Bell, June, 1875; Edward W. Bell, February, 1889; W. E. Bell, November 1, 1890; H. W. Bellard, June, 1882; Emile Berlinder, September, 1878; Arthur F. Bender, 1881; W. J. Berry, July 1, 1889; Victor M. Bethold, September 20, 1883; F. H. Bethell, November, 1890; U. N. Bethell, 1888; George E. Betts, June 1, 1878; Adelle W. Blake, June, 1885; Francis Blake, 1878; J. T. Blake, March, 1882; Jno. L. Blood, September 3, 1889; F. S. Bloodgood, April 14, 1880; J. H. Boeggeman, May, 1878; H. Boutillette, 1879; C. L. Boyce, October 8, 1879; F. J. Boynton, September, 1881; Thos. N. Bradshaw, 1884; Henry W. Breckenridge, June 10, 1879; J. P. Brennan, November, 1880; Joseph M. Brown, May 1, 1879; N. Warren Brown, November 22, 1882; Robert Brown, 1877; Thomas S. Brown, August, 1885; Walter Brown, January 1, 1888; C. H. Brownell, 1879; M. H. Buehler, December 16, 1882; W. W. Bunton, October 1, 1889; E. M. Burgess, November 1, 1881; Chas. B. Burleigh, August, 1879; W. H. Bush, April 23, 1880; John K. Butler, 1878; F. A. Buttrick, August, 1879; C. J. Bryne, August 1, 1879.

John H. Cahill, May 5, 1880; James E. Caldwell, May 1, 1885; A. S. Campbell, August, 1885; Willard L. Candee, August 31, 1877; James F. Canfield, December, 1885; M. J. Carney, July, 1879; I. B. Carpenter, 1882; G. H. Carrigan, June 30, 1879; O. H. Carter, February 1, 1884; J. J. Carty, 1879; J. A. Chambers, June, 1881; Wilson S. Chapman, November 1, 1879; W. A. Childs, May, 1877; J. W. Christie, July 12, 1884; E. A. Clark, April 1, 1883; E. N. Clarke, July, 1880; J. M. Clifford, September, 1889; J. H. Cline, January 1, 1889; Robt. Cline, 1888; D. M. Clower, 1881; R. B. Cochran, February, 1884; Charles D. M. Cole, December, 1889; Minnie E. Cole, December 1, 1884; Dennis L. Collins, May 11, 1882; F. W. Conn, August, 1879; C. H. Conoley, January 9, 1889; W. R. Cook, March 1, 1882; Thomas E. Cornish, 1878; Edward Corrigan, June 21, 1883; E. B. Cottrill, October 10, 1886; D. C. Cox, December 15, 1889; John Crawford, 1887; A. P. Crenshaw, September 22, 1878; J. William Crews, May, 1882; G. W. Crouter, July 1, 1883; J. N. Culbertson, April, 1878; John Cunningham, February 1, 1889; Harry J. Curl, 1888; A. E. Cutts, June 10, 1890.

Frank G. Daboll, March 21, 1879; W. E. Dawson, 1887; C. B. Day, 1885; Frederick M. Delano, 1878; George W. Delany, October 1, 1878; W. W. De Lany, October, 1887; A. K. Dement, June 1, 1890; W. J. Denver, 1877; A. B. Depuy, September, 1883; Robert W. Devonshire, August, 1877; Chas. C. Dickinson, December 20, 1882; Adolph M. Dittmer, May 14, 1888; Amzi Dodd, November, 1886; Francis E. Donohoe, June 30, 1882; Charles B. Doolittle, July, 1878; Thomas B. Doolittle, June, 1877; James Doyle, August 15, 1885; W. R. Driver, 1880; Kenneth J. Dunstan, October, 1877; Charles Durant, May 1, 1888; Thomas Dusenbury, January 1, 1883; T. J. Dwyer, 1881.

H. O. Eanes, August 1, 1880; W. B. Eddy, 1879; Melville Egleston, 1885; Herman Ehrlich, 1877; W. P. Ellis, May 1, 1884; A. H. Embler, May, 1882; Howard B. Emery, June, 1889; U. P. Ennis, November 17, 1883; W. E. Esten, 1880; William R. Evans, September 25, 1878.

C. C. Failing, 1883; J. E. Farnsworth, 1885; J. M. Ferry, September 11, 1886; E. B. Field, January 21, 1880; E. B. Field, Jr., January, 1887; Stephen D. Field, 1877; Frederick P. Fish, November 23, 1881; D. H. Fitch, 1879; Thomas P. Fitzpatrick, 1879; James H. Flanagan, August, 1882; Frederick A. Forbes, October, 1882; E. C. Ford, October, 1882; Wm. A. Ford, July 1, 1884; Geo. W. Foster, March, 1882; C. K. Fraser, May 10, 1889; B. L. Freedy, October 1, 1881; Charles H. Fuller, May 1, 1886; D. P. Fullerton, December, 1889.

A. C. Gallagher, April, 1879; Mary J. Gannon, 1883; C. E. Gardner, October, 1879; W. J. Garvey, September 1, 1880; Joseph A. Gately, June 26, 1889; C. A. Gates, February 7, 1885; W. T. Gentry, 1879; John J. Ghegan, 1877; D. R. Gibbs, May, 1888; J. W. Gibson, November 27, 1882; James W. Gillespie, June 22, 1883; Charles J. Glidden, May 8, 1877; W. G. Good, May, 1880; Willard Graham, May, 1883; Charles A. Grant, March 26, 1883; Arthur B. Green, 1889; Samuel Miller Greer, August, 1890; F. W. Griffin, December, 1887; Adolph A. Gruber, December 16, 1887; E. Alonzo Gurnee, May, 1885.

Charles E. Hall, April 1, 1884; Edward J. Hall, November, 1878; Laura M. Hall, September, 1885; W. D. Hanchett, 1879; Frank W. Harrington, 1875; J. F. Hathaway, July 15, 1888; Hammond V. Hayes, December 7, 1885; W. S. Hays, January 1, 1881; W. G. Heep, November 12, 1885; Louis H. Helsher, December 3, 1879; J. S. Henderson, June 11, 1883; Minnie M. E. Hennigh, 1882; Andrew H. Herzig, October 19, 1884; Angus S. Hibbard, July, 1881; P. Kerr Higgins, September, 1881; Miss Sue Hoffman, March 4, 1884; Alfred E. Holcomb, 1890; E. T. Holmes, May, 1877; Robert B. Hoover, April 1, 1881; W. Hoppins, March, 1888; Francis A. Houston, March, 1885; Charles T. Howard, January 16, 1880; Walter S. Howarth, February 11, 1884; G. W. Hoyt, January, 1883; Charles Eustis Hubbard, August, 1877; S. T. Huebner, 1882; H. S. Huidekoper, January 1, 1886; Leland Hume, October 16, 1885; W. E. Huntington, July 1, 1882; E. A. Hussey, April 25, 1887; W. C. Hutt, Novem-

ber 25, 1883; N. H. Hutton, 1885; Henry D. Hyde, 1879; W. H. Hyde, December 20, 1883.

S. C. Ingalls, December, 1886; Miss Bessie Ingram, August 15, 1889; Thomas L. Ingram, February 2, 1881; A. W. Ives, February, 1884; W. A. Jackson, October 1, 1877; P. O. Jacobs, September, 1890; W. J. C. Jacobs, May, 1884; C. A. Janke, July 10, 1880; W. W. Johnson, June 10, 1884; Martin J. Joyce, November, 1877.

A. Barney Kaiser, October 17, 1885; John Kearns, September, 1879; T. J. Keech, April 1, 1881; W. J. Keenan, 1879; Charles F. Kelleher, October, 1878; Jasper N. Keller, 1879; James A. Kennedy, July, 1884; W. H. Kesterton, September, 1890; Miss Betty E. Keys, May 1, 1882; W. H. Kilbourne, November 1, 1879; L. H. Kinnard, June, 1888; F. E. Kinsman, 1876; John E. Knetzer, January 1, 1890; Frank B. Knight, May, 1880; L. H. Korty, November, 1877; Hermann Kraft, October, 1885.

J. W. Ladd, 1878; M. J. Lane, 1885; S. J. Larned, July 1, 1890; Frederick P. Lewis, July, 1882; George V. Leverett, February, 1886; Theodore L. Liesinger, December 1, 1887; Edward E. Lillie, April, 1879; N. W. Lillie, October 8, 1877; R. N. Litton, April, 1880; B. F. Lloyd, 1883; Thos. D. Lockwood, 1878; Hardy T. Lohmes, April, 1883; Thos. F. Long, 1882; Edmund W. Longley, September, 1881; E. H. Lyon, October, 1880; J. H. Lyons, August, 1889.

J. G. Maben, February 27, 1888; John A. MacCrellish, February 1, 1881; J. E. Macdonald, March 12, 1888; Cecil W. Mackenzie, April 1, 1879; L. A. Madden, 1888; Wm. J. Maiden, October, 1882; George T. Manson, December 7, 1879; Augustus Many, February 8, 1882; S. H. Marriott, August 12, 1889; H. P. Marshall, July 27, 1885; J. J. Martin, April, 1878; T. Commerford Martin, 1878; William D. Martin, June 15, 1883; F. G. Mason, October, 1877; Geo. C. Maynard, 1876; J. D. McAdoo, January, 1885; J. Albert McCabe, February, 1889; C. E. McCluer, 1876; R. T. McComas, September 1, 1878; Edwin L. McCoy, 1885; H. A. McCoy, 1883; John A. McCoy, 1878; Harry G. McCully, July 1, 1880; Charles W. McDaniel, May, 1879; Henry McDonald, November 27, 1887; F. J. McDonough, 1881; James McDonough, 1886; E. McElligott, August 1, 1887; C. E. McFarland, 1880; Lewis B. McFarlane, July, 1879; Alexander McLellan, 1879; John D. McLeod, 1886; W. J. McLoughlin, May, 1882; S. G. McMeen, January, 1885; J. L. McQuarrie, July 1, 1886; Edward P. Meany, July 1, 1886; J. H. Mehaffey, September, 1878; A. J. Mellen, January, 1883; James Menzies, 1881; S. H. Meyers, March, 1884; T. W. Milburn, January, 1882; Norton Miller, September, 1884; G. D. Milne, April, 1879; W. B. Milton, July 1, 1887; John F. Moody, October 27, 1889; R. A. Moore, December 15, 1889; James T. Moran, September, 1884; Jno. M. Moran, August 6, 1879; Richard J. Morgan, August 1, 1890; William J. Morgan, Jr., April 20, 1890; S. Morris, June, 1887; Chas. E. Mosley, April 1, 1889; D. J. Murphy, January, 1881; E. L. Murphy, September 5, 1885; J. O. Murphy, June, 1877; John F. Murphy, April, 1880.

Frank G. Nelson, September 1, 1888; T. Nesbit, March, 1880; Walter R. Newton, June 10, 1890; Chas. A. Nicholson, November, 1879; W. W. Nicholson, January, 1881; W. I. Noyes, November, 1880.

Richard O'Brien, 1877; P. W. O'Brien, 1880; J. F. X. O'Hea, December 18, 1889; W. W. Olheiser, 1884; B. A. Oliver, October 13, 1883; John O'Rourke, January, 1881; Frances Overbeck, May 19, 1883; C. L. Ovitt, 1883; Archibald A. Owens, February, 1889.

W. D. Paynter, January 1, 1879; John C. Peaty, 1881; Fenner H. Peckham, July 13, 1883; W. B. Perkins, December 5, 1887; A. D. Phillips, July, 1881; F. A. Pickernell, 1886; George W. Pierce, February 5, 1880; Thomas E. Pigott, February 1, 1880; Charles W. Pitman, March, 1884; Edward Y. Pittman, June, 1879; G. P. Platt, July 1, 1890; George S. Pond, September 1, 1883; Henry W. Pope, 1877; Frank Powell, September 1, 1890; T. L. Powell, February 14, 1884; Charles W. Price, December, 1882.

K. Raup, October, 1880; M. D. Ray, March 10, 1884; Peter T. Reilly, April, 1887; P. G. Reynolds, July 22, 1881; W. L. Richards, 1878; James Robb, October 26, 1888; A. P. Roberts, November, 1880; E. B. Rogers, September 1, 1887; Charles A. Rolfe, March, 1877; Charles M. Root, January, 1879; Frank C. Ross, December 17, 1880; Isabella B. Ryan, February, 1882.

A. L. Salt, July 7, 1881; H. T. Sapp, September 3, 1883; Jacob Schoch, April 15, 1889; H. J. Schultz, December 26, 1878; C. E. Scribner, 1877; C. G. Seely, November 15, 1881; Thomas Sherwin, March, 1883; E. F. Sherwood, June 10, 1879; Olive Silvers, June 21, 1889; F. C. Simpson, September, 1890; O. F. Sise, January, 1880; Phillip Jacob Skolsky, 1882; W. D. Sloan, July, 1880; A. T. Smith, December, 1879; Alonzo W. Smith, March 16, 1880; Charles H. Smith, October, 1890; Chauncey Smith, October, 1888; C. B. Smith, April 21, 1889; Emor A. Smith, January, 1882; Frank E. Smith, November 1, 1881; Sidney H. Smith, September, 1880; S. Fred Smith, March 7, 1881; H. Snelling, 1885; Stephen D. Snook, May, 1880; John Soderstrom, November 1, 1889; H. Sommers, September, 1887; P. Spencer, August, 1884; Walter N. Sperry, November 1, 1880; Joseph D. Stanford, November, 1879; R. H. Starrett, October 15, 1888; S. H. Starrett, August 1, 1887; W. H. Stedman, October 2, 1882; J. W. Stearns, March, 1879; J. K. Stitt, May 1, 1883; A. C. Stone, October 1, 1881; H. L. Storke, June, 1879; Harry Strout, July 11, 1887; Bernard E. Sunny, March 1, 1879; F. Swaney, June 1, 1887.

Edgar L. Taylor, 1884; William F. Taylor, June 10, 1888; H. B. Thayer, January, 1881; M. F. Thomas, February, 1879; A. K. Thompson, 1878; George K. Thompson, May 15, 1882; M. A. Thomson, May 20, 1889; B. J. Throop, March 1, 1881; Florence T. Toomey, April 4, 1890; Charles R. Truex, September, 1879; William H. Truex, October, 1888; G. S. Tulloch, July, 1887; Alonzo W. Tuttle, July 25, 1885.

Frederick B. Uhrig, October, 1881.

J. Cummings Vail, June, 1880; Theo. N. Vail, 1878; Frederick O. Vaille, November, 1878; Howard T. Vaille, December 26, 1882; W. W. Vaughn, 1884; George M. Van Buren, 1884; Henry C. Vance, 1888.

Thomas H. Wadland, November, 1878; C. P. Wainman, 1877; Clement I. Walker, July 15, 1890; Geo. Y. Wallace, 1883; Frank E. Warner, December 1, 1879; N. G. Warth, January, 1880; James K. Wass, 1886; H. P. Watson, 1881; Thomas A. Watson, June, 1875; W. H. M. Weaver, 1887; J. J. Welch, 1888; W. T. Westbrook, April, 1878; J. B. Whalen, January 1, 1882; Charles E. Wilde, November 13, 1884; H. W. Wilder, 1881; J. R. Wiley, 1878; George L. Wiley, 1877; Edmund S. Willard, May, 1879; Charles H. Wilson, 1877; D. Leet Wilson, January 8, 1880; Eugene M. Wilson, May 17, 1879; J. W. Wilson, August 1, 1885; George P. Wilt, July 19, 1886; Edward A. Woelk, June, 1878; F. G. Wood, 1877; W. H. Woolverton, 1878; R. L. Wright, May 1, 1884; I. O. Wright, July 1, 1890; Walter A. Wright, 1888.

P. Yensen, January, 1884; C. E. Yost, August, 1889.

Noiseless Telephone Call

It frequently happens that at a convention, lecture, or public speaking, some person is wanted at the telephone. This necessitates much scurrying back and forth of messenger boys, considerable confusion, "stage" whispering, and wild pointing of fingers. Perhaps even the speaker must be interrupted while the announcement is made. At any rate the meeting is disturbed and the speaker very much embarassed until the man is finally located.

If the hall is provided with a stereopticon, and most meeting places are, all of this confusion can be very easily avoided. The required notice, such as, "Dr. Smith is wanted at the telephone," is written on a piece of transparent paper and put into the lantern as an ordinary slide, and projected upon the background of the platform. The message can easily be read, even in the daytime and on a light background, and the meeting continued without any interruption.

Wisconsin Commission News

In response to a petition by the Linzy Brook Telephone Company for connection with the Cecil-Green Valley Telephone Company, the Wisconsin Commission recently conducted a hearing on the subject of physical connection between telephone lines, being the first hearing since the law providing for such connection was passed by the Legislature last winter. A similar case involving the La Crosse Telephone company and the toll lines of the Wisconsin Telephone company will be considered later.

Digest of Foreign Telephone Literature

Translated for Our Readers

NEW MACHINE TO COMPUTE ELECTRIC TRANSMISSION LINES

COMPUTATION of electric transmission lines, whether for high voltage or for ordinary telephone and telegraph service has always been a very difficult and tedious process. Conditions between different stations or distributing points differ widely. The loads vary both day and night, and all of these varying circumstances must be met by proper design in the transmission line. The constancy of voltage is perhaps one of the most important considerations to

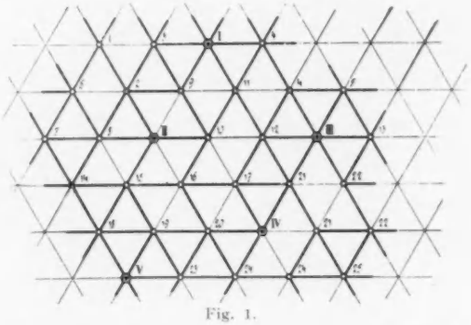

Fig. 1.

be looked after in designing transmission lines. While the voltage at the power or central station may be constant enough, this is not the case at the various distributing points, where the motor or light and general power load may vary many times during the day, so that steps must be taken to safeguard against any abnormal change of voltage at the power station.

A German engineer in a recent meeting showed a computing machine for the purpose of computing transmission lines, demonstrating its practical working, and illustrating its great value to the designing of transmission systems.

Conceive a distributing system, in which parts *I, II* and *III* are feeding stations, and points *1, 2, 3, 4-7* are distributing points. The current is transmitted over this line system, and the voltage is kept constant at the feeding points. The loads at the distributing points are distributed equipotentially over all of the points. $i_2 i_3 i_4$- are therefore load currents, taking their current at the distributing points *1, 2, 3, -6, 7*. We know the cross section and lengths of the different transmission line wires, as also the electric conducivity $g = \frac{q\ 57}{I}$ of all lines which interconnect the branches and distributing points and connect them with the feeding points. We have then:

g_{12} = conducivity of line connecting distributing points *1* and *2*.

g_{13} = conducivity of line connecting distributing points *1* and *3*.

g_{11} = conducivity of line connecting distributing points *1* and feeding point *1* and g_{11} = the sum of conducivities of all lines which converge at distributing point *1* and g_{22} = the same for all lines converging in point *2*, etc.

We have then:

$$g_{11} = g_{12} + g_{13} + g_{15} + g_1\ I$$
$$g_{22} = g_{21} + g_{24} + g_{25} + g_2\ III$$
$$g_{77} = g_{72} + g_{75} + g_{76} + g_7\ III$$

If we calle e_1, e_2-e_7 the voltage loss in distributing points *1, 2, 3-7*; the line connecting the distributing points to the feeding points, then we have seven equations, and to compute a network of any electrical transmission system, we need as many equations with the same number of unknowns as there are distributing points.

A good central station must keep its voltage well regulated to give good service, and when we remember that even a small station may have 40-50 distributing points, not speaking of larger stations with 700 or more, we see that the computation of good transmission systems is a tremendous task. Each distributing point, to be entirely safe, should be computed under various conditions, and various loads, so that the voltage may always be as steady as possible. If we review the work of any central station, we will find that a general average is taken to compute the lines, and that heavier feeder cables and wires are used to be on the safe side, and that the station trusts to the future for the accuracy and correctness of the computations. There is hardly any branch of technology where there is more guessing than in the design of current transmission system, and a machine for the computation of transmission lines is therefore one of the most pressing needs in the electrical industry.

In computing transmission systems we have to deal with linear equations. A computing machine for

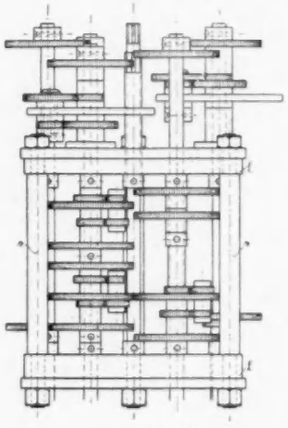

Fig. 2.

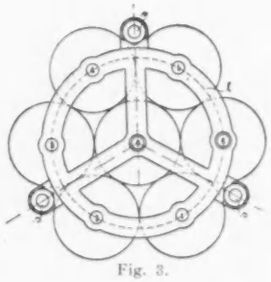

Fig. 3.

this type of work would therefore have to solve linear equations. Consider the following three equations with three unknowns:

$$a_1x + b_1y + c_1z = m$$
$$a_2x + b_2y + c_2z = n$$
$$a_3x + b_3y + c_3z = o$$

The unknowns are x, y, z. The absolute con-

stants are *m, n,* o. The known coefficients are $a_1a_2a_3$; $b_1b_2b_3$; $c_1c_2c_3$.

The machine which solves these equations is a positive system, in which the absolute numbers *m, n, o,* and the unknowns *x y, z,* are expressed by rotations, using any standard, e. g., one rotation, as a unit.

In planning a machine for the above equation, one shaft, *I, II* and *III,* corresponds to one of the three unknowns, *x, y, z.* The numbers of rotation of these shafts are to be equal to the unknowns *x, y, z.* Bevel gear wheels are seated on these shafts, and these wheels, either by means of a second bevel gear wheel direct, or else by the intervention of spur gear wheels, drive the shafts *1, 2, 3, or 4, 5, 6.* **The wheels** are selected in such a manner that the translation relations from *I* to *1, I* to *2, I* to *3; II* to *4, II* to *5,* etc., correspond to the known coefficients, a_1 a_2 a_3 or b_1 b_2, etc.

For easier explanation we will suppose that the unknowns *x, y, z,* and consequently the number or rotations of shaft *I, II, III,* are known. If shaft *I* is rotated *x* times, the shafe *1* makes xa_1 rotations; the shaft *2* makes xa_2 rotations, and shaft *3* makes xa_3 rotations. If shaft *II* is rotated *y* times, the shaft *4* makes yb_1 rotations, the shaft *5* makes yb_2 and shaft *6* makes yb_3 rotations. If shaft *III* is rotated *z* times, the shaft *7* makes zc_1; shaft *8* makes zc_2 and shaft *9* makes zc_3 rotations.

If now the product xa_1, yb_1, zc_1, etc., i. e., the number of rotations of shafts *1, 4, 7,* are added by means of the differential gears D_1-D_4, we will find that the shaft *10,* corresponding to the first equation, has rotated *m* times. The same applies to the second and third equations, and shaft *II* will have made *n* rotations and shaft *12* will have made *o* rotations.

In any positive system it is immaterial for the interrelation of the numbers of rotation of the different shafts, which shaft does the driving. If instead of shafts *I, II, III,* the shaft *10* is rotated *m* times, the shaft *11, n* times, and shaft *12, o* times, then shaft *I* must have rotated *x* times, shaft *II, y* times, and shaft *III, z* times. The equations are therefore solved. The numbers of rotations of the different shafts are easily read off on scales and indicators. The machine is built up on the basis of the following equations for power transmission lines:

$(e_1 - e_2)g_{12} + (e_1 - e_3)g_{13} + (e_1 - e_5)g_{15} + (e_1 - eI)g_1I = i_1.$

$(e_2 - e_1)g_{21} + (e_2 - e_3)g_{23} + (e_2 - e_4)g_{24} + (e_2 - e_7)g_{27} + (e_2 - eI)g_2I = i_2.$

$(e_3 - e_1)g_{31} + (e_3 - e_{32})g_2 + (e_1 - e_5)g_{35} + (e_4 - e_2)g_{42} + (e_4 - eI)g_4I + (e_4 - eII)g_4II = i_7.$

$(e_5 - e_1)g_{51} + (e_5 - e_3)g_{53} + (e_5 - eIII)g_5III$ $i_5.$

$(e_6 - e_3)g_{63} + (e_6 - e_7)g_{67} + (e_6 - eIII)g_6III = i_6.$

$(e_7 - e_2)g_{72} + (e_7 - e_3)g_{73} + (e_7 - e_8)g_{76} + (e_7 - eII)g_7II = i_7.$

$(e_1 - e_2)$ etc., = the difference in voltage.

g_{12}, g_{13}, etc. = the conductivity factors.

Combination $(e_1 - e_2)g_{12}$, etc., = line currents.

i_1, i_2, etc., = load currents.

This has the following advantages:

1. These equations avoid the sums of conductivity values g_{11}, g_{22}-g_{77}, and the necessary translations for such large values are not needed.

2. These equations express the conditions of the current in the transmission lines. The member $(e_1 - e_2)g_{12}$ corresponds to the current in the line between distributing points *1* and *2*; the member $(e_1 - e_3)g_{13}$ corresponds to the current in the line between distributing points *1* and *3*, etc.

Assume for a start that the voltages at the different distributing points are known and given as numbers of rotations of certain shafts. The first thing will be to formulate the differences in voltage $(e_1 - e_2)$ $(e_1 - e_3)$, which is done by means of differential gears. The resulting rotations must be multiplied with the conductivity factors g_{12}, g_{13}, etc.; or, in other words, must be translated from *1* to g_{12}, g_{13}. All that is now necessary is to add together the resulting rotation numbers by means of the differential gearing; these rotations corresponding to the current circuits $(e_1 - e_2)g_{12}$ or $(e_1 - e_3)g_{13}$, etc. The result will be load currents i_1 i_2-i_7, which are also rotation numbers. If the positive system is established in this way, it is immaterial, as said before, which shaft is used to operate the machine.

If instead of the shafts corresponding to the voltage value, those shafts are used whose rotation numbers correspond to the load current, i_1, i_2-i_7, then those whose rotation numbers correspond to these voltages will rotate e_1, e_2-e_7 times, and the other shafts, corresponding to the current on the line, will rotate $(e_1 - e_2)g_{12}$; $(e_1 - e_3)g_{13}$ times. We have then the voltage loss and condition of the line current in the transmission system. These are the principles of the machine. But various peculiarities of transmission lines have been used to perfect it.

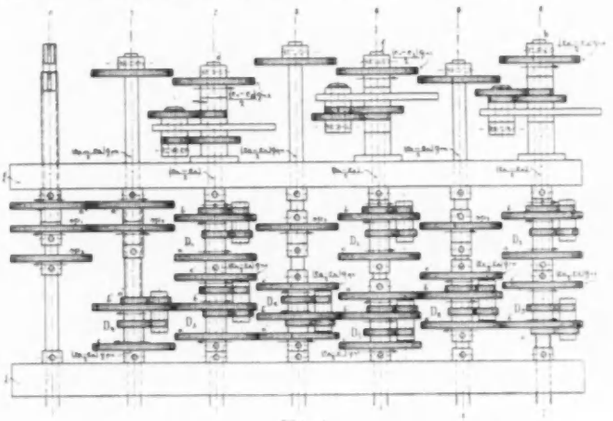

Fig. 4.

The equations usually used in figuring transmission lines have been figured from the distributing points, so that each of these distributing points has one definited equation. (The distributing points will be called "junction points" in this article, so as to accommodate the specially coined word "junction point gearing," coined by the author to name his special system of gearings.) Each junction point has a definite voltage value and the unknown e_1, e_2-e_7 correspond to the same. Every junction point has also a certain load current i_1, i_2-i_7. This natural interrelation between the junction point, the equation for the transmission lines, the voltage loss, and the load current has led in the machine to a design of a so-called "junction point system." Such a system must have:

1. The differential gears which add up the cur-

rents converging in one junction point.

2. A shaft whose rotations correspond to the voltage values.

3. A shaft whose rotation number is equal to the sum formed by the differential gear, i. e., equal to the load current of the junction point in question.

Just as we can consider a transmission system to be made up of junction points interconnected, so we can also build a machine of junction point gears, which are interconnected by means of translation gears, so that they correspond to a network and its equations. For example, to get the differences (e — e), it is necessary to translate the rotations which correspond to the voltage losses from one junction point drive to another, i. e., from n to p. This difference must be multiplied with the conductivity factor of the line g , i. e., the rotation must be translated to g , and the product of the currents between n and p, *i. e.*, the rotations must be translated to junction points n and p, where all currents are added by the differential gears, and give the load current at that point. The junction point gears are placed in the machine on a vertical bed plate, so that the projections of the voltage shaft e in the center of the system, which corresponds to the voltage value e, coincides with the junction

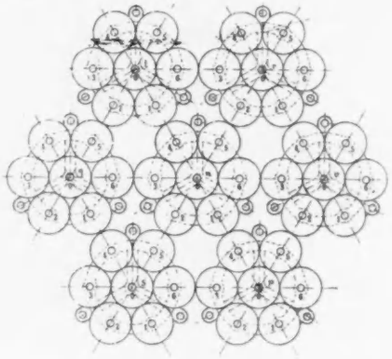

Fig. 5.

points of the transmission system which is traced on the bed plate.

Instead of placing the junction point system in the manner required by a definite system or network, it has been found simpler to lay the lines out in the form of a regular polygon, and to change the plans of the network when necessary. The angles of the polygon will then correspond to the junction points, and the sides of the polygon to the transmission lines. This makes it possible to compute any network of wires, no matter how complex, provided there are a sufficient number of junction point gear systems in the machine. The regular hexagon was found to be the best for this purpose, and Fig. 1 shows the same. For every center in a polygon we have a junction point drive gear. The machine represents, therefore, a network whose wires correspond to the sides of a regular hexagon. But any side of this hexagon may be omitted, according to the layout of the transmission system.

The first problem is to bring the designed transmission system into the polygon form, and the heavy lines in Fig. 1 show such a design. All that is now necessary is to make the connections between the proper junction point gears, as required by the network. If more than six transmission lines meet in one point, one junction point gear is not sufficient, and two such gears must be used. Two such gears will therefore represent one junction point, and the connecting current conductors must have an infinite conductivity value, or in other words the voltage difference (e — n) of the two junction point gears must be equal to zero. The shaft whose rotations correspond to this difference must not rotate and must therefore be locked.

To bring any desired network of power lines into the polygon form, an auxiliary is used. A large board has short tubes arranged in regular hexagonal positions corresponding to the junction point gears of the machine. These tubes are sunk into this board and have pins which fit into the tubes and are held there by springs. At the head of these pins are small slits into which narrow brass strips, equal to the length of the hexagon sides, may be fitted and held there by screw-nuts. The points represent the junction points, and the brass strips the transmission lines. The board with the tubes represents the machine with the junction point drive. The pins are fitted into the various tubes on the board and interconnected by brass strips, corresponding to the proposed transmission system, and can easily be brought into the required hexagonal form. As said before, voltage differences, as also the products of the currents on each line for two junction points are only figured once for any of these pairs of points. As in the hexagonal formation, six lines converge in every junction point; we get for every one of these junction points three differential drives for the voltage and three translation gears. The differential drives and gears, as also the necessary connections between the junction point drives, are interconnected by means of spur gear wheels, set in the junction point gear system.

The entire machine, therefore, consists of junction point gear systems, which are repeated according to the number of junction points. To understand the machine it will therefore suffice to describe one of these systems.

Figures 2 to 5 show such a system. Figure 2 shows the horizontal projection of the gearing; Fig. 3 shows the vertical projection; Fig. 4 is a plan with figures at the proper gears to show the working, and Fig. 5 shows the position of the junction point gear system of the machine.

Two bearing rings or beds 1, supported by three columns s, carry seven shafts, one shaft o in the center, and shafts 1, 2, 3-6, grouped around the central shaft in form of a regular hexagon. The central shaft o corresponds to the voltage factor; three of the outer shafts, namely, shafts 2, 4, 6, to the voltage difference

$\frac{1}{2}(e_n - e_s)$; $\frac{1}{2}(e_n - e_t)$; $\frac{1}{2}(e_n - e_v)$; the shafts 1, 3, 5 to the currents $\frac{1}{2}(e_p - e_n)\ gqn$; $\frac{1}{2}(e_q - e_n)\ gqn$; $\frac{1}{2}(e_r - e_n)\ grn$.

In the following explanation only the terms: "voltages," "load currents," and "line currents" of the junction point gear systems will be used, with the understanding that the number of rotations are meant, which correspond to the voltage load and line current.

The junction point gear in question belongs to the junction point n. The wheel sp is seated on shaft o and engages with the wheel sp_3, which is seated movably on shafts 1, 3, 5. These wheels sp_3 engage the wheels of the adjoining junction point p, q and r, as is seen in Fig. 5*d*, or, in other words, transfer the

voltage pf of the junction point n to the adjoining points p, q, r. A second wheel sp_2 is also fastened immovably on shaft o, and this wheel drives the wheels of the differential gear system D_1, D_2, D_3, which are movably seated on shafts *2*, *4*, *6*. The wheels b which carry the planet wheels of this differential drive are driven in the same same way by the adjoining junction point gears s, t, v, as is done in the case of the adjoining points p, q, r, from the n-point. They rotate, therefore, with the voltage e , e , etc.

The wheels c of the differential drive make $c = \frac{a-b}{2}$ — rotations, according to the equation of the differential drive $c = \frac{a+b}{2}$, if we consider a, b, c, as the rotation numbers of these wheels. As the arrow shows, the wheels a and b rotate in opposite directions, and the rotation to the right is called positive. We have then the voltage differences:

$$\frac{e_n - e_s}{2}; \quad \frac{e_n - e_t}{2}; \quad \frac{e_n - e_v}{2};$$

Wheels c are firmly joined to shafts *2*, *4*, *6*, so that these shafts represent the voltage differences. On

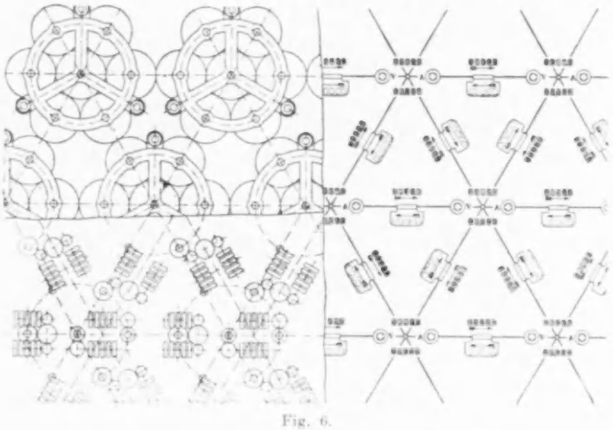

Fig. 6.

these shafts on the outside of the bearing plate are the gearings g. Planet wheels are used for these translating gears, as they give better results and can make a large number of rotations and translations with a few wheels. If gears g have multiplied the voltage differences with the respective conductivity factors, and the wheel d turns $d = \frac{(e_n - e_s)\, g\, n\, s}{2}$ times, then the wheel $f = \frac{(e_n - e_t)\, g\, n\, t}{2}$ times, and the wheel $h = \frac{(e_n - e_v)\, g\, n\, v}{2}$ times. The resulting products are then transferred or sent over to shaft *5* of the junction point s to the shaft *1* of point t, and shaft *3* of point v. These shafts *1*, *3*, *5*, of the junction point n are also driven by wheels c^1 of the differential systems D_4, D_6, D_8, from the junction points p, q, r, with line currents:

$\frac{(e_p - e_n)\, gpn}{2}$; $\frac{(e_q - e_n)\, gqn}{2}$ and $\frac{(e_r - e_n)\, grn}{2}$.

Shafts *1*, *3*, *5*, rotate, therefore, according to one-half the value of the line current. The wheels c^1 of the differential drive D_5, D_7, D_9, which rest loosely on the shafts *2*, *4*, *6* are driven by the shafts *5*, *1*, *3* of the adjoining junction points s, t and v. The adding of the line currents converging in one junction point, is done in the following way: Wheels a^1 and a^{11} on shaft *1* are connected with each other by a hollow shaft. One wheel a^1 engages another wheel a^{11}. This wheel a^{11} is also seated on a hollow shaft which ends like shaft o on the outside of the bearing bed, having a square head for the insertion of a key, and being used to connect two junction points which lie at some distance from each other. As a rule when no such connection is to be made these wheels a^1 and a^{11} are locked. When such a connection is to be made these wheels are rotated.

Figure 6 shows a front view of the machine, as also several sections, illustrating the interrelation and working of the wheels, the driving of the indicators and registers. This machine is set for a network of wires in hexagonal form with the indicators to read off the load current, the voltage loss and the line current. For the line current two indicators are used which show the magnitude and direction of the current. The front views show the opening to insert the keys for the load currents and the voltage shafts, both of which can be regulated by hand cranks. The practical working with this machine is very simple. The projected transmission network is brought to the hexagonal form, as shown previously. The proper gears are set according to the various factors, and the proper wheels and shafts locked. Then the different load currents are set at various junction points by rotating the respective shafts. The result gives the voltages and line currents in the entire network and can be read off on the indicators, correct down to 1/100 volt or 1 ampere.

As the variations and pecularities of the different sections of a network are really only rotations of shafts and wheels on this machine, the computation of the same is an easy matter. If the different load currents are changed, until the indicator readings on the machine coincide with the possible voltage or current measurements found previously on some points of the line system, we can obtain definite information of the voltages, current conditions, capacities and efficiency of the entire transmission system.

The defects of the line system can also be determined, and better than that, the means of overcoming the defects can be found. Great voltage losses and voltage drops, overloads on current and other troubles can be relieved by changing the feeding point at that part of the system or by other means. The important point is, that the machine shows the results of possible changes and the influence on the network, and measures can be taken to remedy matters with the assurance that they will be correct, and large sums of money can be saved.

To change a junction point into a feeding point, the voltage value of the respective shaft is rotated back to zero, as the voltage loss of a feeding point is zero. The load current is also rotated back to zero. The junction point is changed to a feeding point and the new combination can be computed. It is possible with this machine to compute the differences of load on currents under varying circumstances and thus provide proper lines and proper means for efficient transmission of power, no matter whether it be for high power or only for the relatively low current used for telephone and telegraph work. The results of sudden voltage

drops and changes are determined by this machine and steps can be taken to safeguard against such incidents. In fact there is hardly any problem in this line which cannot be solved with the aid of this machine.

As regards the mechanical features of the machine they have been worked out so carefully, that errors due to faulty mechanism are almost excluded. The dead center trouble with geared wheels need not be feared in this case, as the shafts of the load currents always rotate in one direction. In the case of the line current shafts where the direction of rotation changes, this is of little influence, as the change affects the adjoining junction point system only. The lost rotation is therefore so small that it causes no serious effect especially when we remember that one entire rotation is equal to 1/100 volt or one ampere only. A mistake on part of the operator is at once apparent on the indicator, for under given conditions, e. g. since $(en—ep)\ gnp$ is equal to the line current between the junction points n and p, the current in this case at en equals 1 and at ep equals 0, must correspond to the gear system gnp. If this is not the case a mistake has been made and must be corrected. The same is true in other similar cases.

While the cost of such a machine is high, when considered by itself, it is very low when we consider the saving of time in computing transmission systems and the general network of wires, and the saving effected by the fact that costly errors in building these lines are eliminated.—*Elektrotechnische Zeitschrift.*

Commercial Range of Transmission*

With the growth of the Western section of the country there has come an increasing demand for the transmission of speech to distances greater than 1,000 miles and a problem has arisen quite as difficult as that confronting the engineer who transmits large quantities of electrical power over long distances. In certain ways the problem is even more complicated since the transmission must be effected without serious loss in intensity and also without apreciable change in the form of electrical wave transmitted. At present the telephone companies are preparing to meet the problem of extending the limits of satisfactory commercial operation from the Atlantic coast cities to points beyond the Rocky Mountains, which is now the western limit.

To effect this improvement involves the whole telephone plant in the region affected. This is evident from a consideration of the system of connection involved when a subscriber in New York City is talking with one in Chicago. The connections are as follows:

a. From subscriber's instrument to the local exchange board;

b. From local exchange to outgoing toll board, over toll lines;

c. Over long distance toll lines to switching board in Pittsburg;

d. From Pittsburg over toll lines to Chicago toll board;

e. From Chicago toll board to local exchange;

f. From local exchange to subscriber in Chicago.

Thus, there are five switching points between the two subscribers, and at every switching point the resistances of the switching apparatus adds to that of the long connecting lines and lowers the efficiency of transmission of the talking currents.

Another feature which is rendering long distance transmission more difficult is the growing necessity of putting the telephone lines under ground, for greater and greater distances as the municipalities passed through extend their borders. As the capacity of underground cables is far greater than that of aerial lines the difficulties of transmission are increased by this change, or the effective distance of transmission is increased.

While there has been a steady advance in the quality of instruments used, this growth has not kept pace with the substitution of cables for overhead wires, so that other means must be relied upon for improvement and extension of service.

The greatest aid thus far discovered is the "loading" system devised by Prof. Pupin, who discovered that if induction coils be placed at intervals along the telephone cables, the capacity of the lines may be compensated for and the distance of possible transmission greatly extended. Thus the efficiency of transmission is increased as much as two to three times that of the same cables without loading.

An added effect can of course be obtained by lowering the resistance of the lines by increase in area of wires used. By this means the transmission losses, due to the switching apparatus interposed in long distance work, may be made up by the use of more copper in the lines joining switching points. It becomes an interesting problem in finance to figure what changes will affect the desired increase in commercial range of speech transmission with the greatest returns for the money invested. This problem becomes of especial interest when it is desired to add the necessary apparatus so that the lines may be used for the greatest possible number of messages in a given time.

It is common practice to arrange lines to transmit simultaneously telegraph and telephone mesages. More than this, by properly combining the lines, more than one telegraph message may be sent at the same time, and it is even possible for the wires to transmit more than one telephone message at one time. Thus, in addition to loading the lines, the telephone engineer plans to increase its efficiency by arranging the line to accommodate both kinds of service. With two pairs of wires between, say, New York and Pittsburg, it is possible to transmit, at the same time, three telephone messages and eight telegraph messages.

*Abstract of Lecture by Dr. Jewett before the senior class in Electrical Engineering, Cornell University.

Attend Theater by Telephone

Spectators at the New England Industrial and Educational exposition in Boston could hear the entire show playing at B. F. Keith's theater free of charge by means of an unique telephone arrangement. The New England Telephone & Telegraph Company installed 48 watch-case receivers at Mechanics' building. Any one could pick up one of these receivers and hear the entire performance. Two large transmitting discs were located in the footlights of the theater. The sound was sent over the wires to a giant receiver at the exposition. The 48 branch lines ran from the receiver. The most remarkable part of the demonstration was when Charles Kellogg, the great naturalist, was singing, his notes being heard as clear as a bell over the telephone. This exhibit was one of the great features at the exposition.

The Law and the Telephone

By E. J. Wenner

CONTRACT FOR SERVICE—SHORT TERM RATE—LONG TERM RATE—CHARGE FOR TRANSFERRING INSTRUMENTS.

THE case of *Colorado Telephone Company* v. *Charles G. Fields,* appealed from the District Court to the Supreme Court of New Mexico, is interesting to persons engaged in the operation of telephone exchanges, for the reason that it is the first decision by an appellate court pertaining to the reasonableness of a charge for installing or transferring telephone equipment.

The telephone company received from the City of Albuquerque a grant of permission for a license to erect in, upon, across and along the streets, alleys and public grounds of said city all necessary poles, wires, fixtures, conduits, etc., used in the operation of a telephone exchange. The franchise provided that within fifteen days after its adoption a contract should be entered into between the city and the company in which rates to be charged should be specifically agreed upon. The contract was properly drafted and signed and gave to the company a right to charge $36 per annum for residence telephones within a radius of one mile from the central office.

The defendant, Fields, applied to the company for the installation of a telephone in his residence to remain for a term of three months, and pursuant to the request the instrument was installed at a cost to the company of $2.50. Within a short time Fields changed his place of residence to another portion of the city and requested the company to change the telephone to his new place of abode. This was done by the company at a cost of $2, and under an agreement to retain the instrument for three months.

The telephone company had adopted a rule which provided that subscribers should pay the cost of installations and renewals in case they did not enter into a contract for service extending over at least one year. Fields refused to contract for service for a year and declined to pay the charges assessed against him for installation and removal. The company brought action against Fields for $4.50 and to its complaint a demurrer was interposed and sustained. The company stood upon its pleading and appealed to the Supreme Court.

In affirming the decision of the court below and in support of the contention of Field's attorney in resisting the payment of the charges, the court made use of the following language.

"A public service corporation is desirous of securing a charter authorizing it to use the streets of the city of Albuquerque for its purposes in the construction, maintenance, and operation of a telephone system. The city council is desirous of protecting the people of Albuquerque from unjust charges for telephone service, and consequently exacted from the public service corporation the contract in question. It is perfectly apparent that the city council did not intend to prescribe maximum rental rates for only a portion of its inhabitants within the district mentioned in the contract. It proposed to prescribe maximum rental rates for all of its people. It therefore did not contract merely for those people who would make an annual contract for a telephone, but the words "per annum" were inserted in the contract as furnishing a mode of computation merely for a rental charge. This evidently was the sense in which the words were used by the city. To conclude otherwise would be to convict the city council of the grossest failure in duty. In view of the rules of construction hereinbefore noted, there seems to be no difficulty whatever in holding that this is the true construction to be placed upon this contract. It is clearly susceptible of such construction, and the rules of construction seem to require it.

"Appellant seems to justify the charges for installation and removal on the ground that they are made in pursuance of a reasonable regulation on their part. We cannot understand, however, that a regulation can under any circumstances be adopted by a public service corporation which will result in increasing a rental charge above what has been fixed by contract as a maximum charge. This was attempted in *Johnson* v. *State,* 113 Ind. 143, 15 N. E. 215, and it was held to be invalid. And the obligation to furnish telephone service at not to exceed a specified rental charge certainly must include the installation of a usable appliance connected with a system."

RIGHT OF TELEPHONE COMPANY TO TRIM TREES—REASONABLE TRIMMING—WRONGFUL TRIMMING.

Annie C. Salbaugh brought suit against the Omaha Electric Light and Power Company in the District Court of Douglas county, Nebraska, in which she recovered damages because of alleged unlawful trimming of trees located between the lot and curb lines in front of her residence property.

It appears that in 1884, defendant's assignor was given a franchise to use the streets, alleys and public grounds of the City of Omaha, for the purpose of erecting and maintaining poles, wires, conduits, etc., found necessary in the furnishing of light and power. A few years later the plaintiff purchased a lot in said city and at the time trees were growing between the sidewalk and the curb line. Several years later the defendant built a line of poles through the trees and attached wires thereto. At the time of the construction the wires were suspended above the trees and later the limbs grew up to and among the wires and interefered with them. The city building inspector gave the company permission to trim the trees and without plaintiff's knowledge the limbs were cut back about fifteen feet. She claims the trimming depreciated the value of her property and brought action against the company on that account.

The following is a quotation from the opinion of the Supreme Court: "The defendant's counsel argue with great force and learning that the owner of plaintiff's lot at the time the trees were planted was charged with notice that in the proper use of said street for public purpose it might become necessary to trim or even remove the trees, and her property rights therein are subject to the greater right of the public, and that the defendant stands in the shoes of the public with reference to the acts referred to in the petition. There is no proof in the record that the city council of the city of Omaha ever enacted an ordinance for the purpose of controlling the planting or maintenace of shade trees upon the streets of said city, or providing that such trees might be trimmed or removed whenever they interfered with public service, without compensation to the lot owner, or that said trees were

planted subject to any ordinance other than the one directing that limbs of shade trees shall not be permitted to grow within a certain distance of the sidewalks in said city; nor is there any proof that the plaintiff, in maintaining her trees in the condition in which they existed before defendant trimmed them, violated any ordinance of the city. The defendant, therefore, must justify under the terms of its franchise, and the constitution of the state. An application of the fundamental law to the record in this case amply supports the judgment of the district court.

"To the argument that the plaintiff's cause of action arose in 1884, it is sufficient to say that the owner of the plaintiff's lot could not know at that time that the defendant would erect the poles and string the wires in question; nor could the plaintiff have known, when the wires were strung, that the defendant would years thereafter trim her trees, and thereby damage her property. It was feasible to remove such wires to the alley, and it was possible they would be placed in conduits beneath the surface of the street before the necessity might arise for trimming the trees. The plaintiff's cause of action arose when her property was damaged, and the statute does not bar that action."

REASONABLENESS OF RULE REQUIRING THREE MONTHS' PAYMENT IN ADVANCE—HELD NOT A DISCRIMINATION—RIGHT OF COMPANY TO EXTEND CREDIT IF IT DESIRES.

J. H. Vaught brought suit against East Tennessee Telephone Company to recover $36,500, which was claimed as a penalty of $100 per day for one year on account of alleged discrimination against plaintiff. The defendant company had a rule requiring the payment of three months' rental in advance before installing a telephone instrument. Plaintiff claimed that this rule was waived with some subscribers, but was insisted upon when he applied for service, and this suit is brought on that account.

Whether a telephone company has a right to insist upon payment in advance for any number of months more than one has been considered a mooted question, and this case reported in 130 *Southwestern Reporter* at page 1050, and 31 *L. R. A.* (N. S.) page 313, will be considered a pioneer case in holding such a regulation reasonable. There are other cases in which a court has held that an advance payment might be exacted of some subscribers and the requirement waived in favor of others. In the case of Yancey v. Batesville Telephone Company, 81 *Ark.* 491, 99 *S. W. Reporter* 681, the court in deciding a case of this kind used the following language:

"Every company is entitled to compensation for telephone facilities furnished by it. It may require charges for such services to be paid in advance. Hewlett v. Western U. Teleg. Co. (C. C.), 28 *Fed.* 181; Jones Teleg. & Telep. Cos., page 431, and cases cited; and Croswell, Electricity, page 371, and cases cited. This power is given for its own protection. In the exercise of it, it may extend credit for such charges to persons it may deem deserving. This is a reasonable exercise of the power, and it is essential to its success. No rule can be laid down by which the credit to which each person is entitled can be determined. This is dependent upon various circumstances, such as the amount of property he may have over and above his exemptions and liabilities, his promptness in paying his debts, his being contentious, a wrangler, or fault finder, his honesty, integrity, and other qualities. The credit due each individual depends upon himself. It cannot be fixed by any rule, but must be, and is, left to the company to determine. The statute forbidding discriminations does not deny the right. It does not come within the evils the statute was intended to suppress. All are required to pay the same rates for the same service in like situation. But the time when it should be paid is within the peculiar province of the company to determine. This is a right of creditors, and there is no reason why it should be denied to telephone companies."

Hutchinson's well-known work on the law of Carriers is an authority and cites cases sustaining the right of a railroad corporation in requiring the prepayment of freights from some customers and allowing shipment before collection for others.

On account of the importance of this question and that our readers may get the exact language of the court in deciding this case we quote from the opinion as follows:

"We are entirely satisfied with the soundness of the rule, as well as with the reasons underlying it, announced by several courts and Mr. Hutchingson, and are unable to agree with the contention of counsel for plaintiff in error that a telephone company, by the character of its service, is to be placed in a different class from that to which other carrier corporations belong, in so far as this rule is concerned. The mere fact, as is insisted, that it may serve communities restricted in number, and maintain a limited number of exchanges, can have no bearing on this question. For it is well known to all that, while there are such companies with a limited service, there are others constituting systems, each one of which covers like a web many states, whose wires extend into a vast number of communities and have a patronage greater than any railroad system in the country. That a telephone company thus operating should be excluded from the privilege accorded to the carrier of freight or passengers would, to say the least, be remarkable; and, if granted to it, then it must be equally so to such a company operating in a less extensive area.

"Nor do we agree with counsel in their criticism of the case of Yancey v. Batesville Teleph. Co., *supra*. The opinion in that case is in line with the best authorities, and contains, as we think, a sound exposition of the law.

"Waiving the question urged by counsel for the defendant in error, that the statute of 1885, in so far as it provides a penalty of $10 a day against a telegraph or telephone company as long as the 'discrimination' denounced by it continuous, is violative of page 21, article 1, of our constitution, yet we do not hesitate to say that a claim such as is set up in this litigation, of $36,500, the aggregate of penalties for 365 days, during which it is alleged the defendant in error was guilty of 'discrimination' in its refusal to place in the home of the plaintiff in error an instrument, for which, with telephone service, it is to receive the trifling sum of $2 per month, unless three months' rental was paid in advance, is so out of proportion to all possible injury resulting from such refusal, so unconscionable in character, as to stagger a court of law, as much as it would a court of equity; and if it were held that such a case necessarily fell within the letter of this statute, the court might feel itself forced to answer this question. Finding, however, that the act complained of is not within the tenor of the statute, the issue presented by this insistence is neither examined nor determined.

"The judgment of the court below, dimissing the suit, is affirmed."

DEPARTMENT of RAILWAY TELEPHONES

Telephones at the Northwestern Terminal

How the Public Is Served

THE traveling public likes to telephone. People leaving town, appreciate the sensation of talking with their homes or offices a few moments before the train leaves; those passing through town and who have to wait between trains relieve the tedium by calling up their friends for a little chat, and those just returning from a trip make haste to give notification of their arrival. And it all means business for the telephone company.; business which telephone companies are generally eager to get.

Northwestern Terminal at Chicago.

Almost from the time the new Northwestern Terminal was planned in Chicago, the Chicago Telephone Company began to arrange for adequate telephone facilities, for it was recognized that the traveling public likes to telephone and will add considerable revenue if it is made convenient for it to do so. When the station was finally opened to the public last June, the telephones were then all ready to be used, and a good many of them have been almost constantly in use ever since. The building itself is beautiful, and the telephone facilities are strictly in keeping. The keynote of the whole system seems to have been accessibility, for no matter where a person may be in the station, it is not necessary to go more than a few steps to the nearest telephone booth.

About the first thing the keen-eyed telephone man will see as he steps into the building from the main entrance on Madison street will be the main pay station just to the left of the entrance. Twenty booths are provided, six of which have direct line connections to the exchange for local service only, while fourteen are terminals from the switchboard where regular pay station service is given by attendants.

In the southeast corner of the second floor, which is the main waiting room, is another public pay station having six booths, all of which are terminals from the switchboard. In the southwest part of the second floor is another pay station consisting of ten booths. This station is somewhat secluded and is for the use of ladies only. An entrance can be had both from the main waiting room and from the ladies' retiring room, thus giving privacy that will be much appreciated, especially by women who are traveling alone.

In addition to these, are a number of booths scattered around the train shed at convenient points, while in the barber shop and smoking room and in the ladies' retiring rooms on the third floor are other booths, all placed with the intention of making it easy for the people to use the telephone.

In the larger pay stations, the booths which are connected directly with the exchange are set off from the others by brass railings. One can quickly enter these booths and receive direct service, the regular prepayment mechanism looking after the company's interests in the transaction. In the other booths, the switchboard operator takes charge, locates the party desired, and assigns the booth to the person making the call. A young man attendant is also on duty to indicate the booth that the

Department of Railway Telephones

This department is established as a permanent feature of TELEPHONE ENGINEER. The progress of the art of telephone train dispatching, its technical development, its news, and the elucidation of its mysteries for the non-technical worker will be found each month in these pages. The editors invite the problems and solicit the co-operation of the many readers of TELEPHONE ENGINEER in all parts of the world whose interests lie along these lines.

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call will be made from and also to serve, in any way that he can, the convenience of the traveling public.

The railroad company has nothing to do with the installation or operation of the pay station. That is strictly up to the Chicago Telephone Company. And yet a casual observer might well think that the booths were operated by the railroad, and were as much a part of the conveniences furnished for its patrons as are the beautiful rest rooms or the various information bureaus which are scattered about the station. A large part of this illusion may be caused by the fact that all of the telephone equipment is made to harmonize so closely with the regular furnishings of the station that one would be willing to take oath that they were all furnished by the same manufacturing concern and were bought on the same order. The booths, switchboards, and chairs all harmonize perfectly with the seats in the big waiting rooms, and where brass railing is used it is of the same size and style as that used elsewhere in the station. Even the letters which compose the word "telephone," which is all the advertisement that the booths have, are of the same standard style used in other signs about the building. And above all things, the same spirit of kindly helpfulness prevails that is so noticeable in the other departments of the station; a feeling that an honest attempt is being made to serve the public in the way it wants to be served.

L. S. & M. S. Installs Five New Circuits

The Lake Shore & Michigan Southern Railway has found the telephone so satisfactory for dispatching trains over its lines that the New York Central recently placed another order with the Western Electric Company for enough of its selectors to equip five new circuits. The Lake Shore and Michigan Southern is already operating about 1,100 miles of circuits by the telephone, and the addition of the five new circuits will bring the total mileage up to about 1,850 miles.

The additional equipment will consist of a train dispatching circuit to run from Hillsdale, Mich., to Lansing, Mich., with a branch from Homer, Mich., to Dundee, Mich. The dispatcher for this circuit will be located at Hillsdale, and 26 stations will be equipped.

A second train circuit will run from Fort Wayne, Ind., to Jackson, Mich., with a branch off from Bankers, Mich., to Ypsilanti, Mich. There will be thirty-six stations on this line, and the dispatcher will also be located at Hillsdale.

Another train circuit will run from Detroit, Mich., to Jackson, with a branch off from Monroe, Mich., down to Toledo, Ohio, and another one off from Grosvenor, Mich., to Fayette, Ohio, with a short branch from this line at Lenawee Junction, Mich., to Adrian, Mich. The dispatcher for this circuit will be located at Detroit, and 41 stations will be equipped.

Another message circuit will also be run out of Detroit, but there will be no stations on the line between Detroit and Monroe, Mich. From there on, however, to Jackson, with a branch off from Lenawee Junction to Adrian, Mich., and Fayette, Ohio, there will be twenty-two stations equipped.

An interesting feature of this installation is a special switching device which permits the stations between Grosvenor, Mich., and Fayette, Ohio, to be switched over to the train wires when desired. The wire on this circuit will be No. 8 iron and No. 9 copper.

In addition, a message circuit will be run from Fort Wayne straight through to Jackson, Mich. On this line twenty-two stations will be equipped. No. 9 copper will be used for all of the above circuits.

Claims Misdirection of Patent Application

Charging Herbert E. Atchison with misdirecting the application for letters of patent on an improved telephone and telegraph pole invented by the plaintiff, alleging that Atchison had surreptitiously applied for the patent under his own name after the models had been entrusted to him by the inventor, Jack Booth has filed suit in the third district court at Salt Lake, Utah, against the American Post and Pole Company, seeking damages in the sum of $6,100.

Booth declares he employed Atchison to secure the letters of patent for him and that he has never received such letters, but that on December 14, 1909, letters of patent on the invention, as he had entrusted it to Atchison, issued from the patent department. He further alleges that these patents rights were transferred to the American Post and Pole Company by Atchison, for which he received 100,000 shares of capital stock in the corporation.

In addition to damages, Booth asks that the court declare Atchison's holdings in the corporation invalid and that the company be restrained from manufacturing, having manufactured, selling or otherwise disposing of the patented pole.

Cincinnati, Hamilton & Dayton Telephones

The Cincinnati, Hamilton and Dayton Railroad has recently placed an order with the Western Electric Company for 79 of its telephone selectors and associated telephone apparatus to equip three new circuits. One circuit will extend from Indianapolis, Indiana, to Hamilton, Ohio, a distance of 99 miles, and on it 21 selector station equipments will be installed. The dispatcher will be located at Indianapolis.

The second circuit will extend from Dayton, Ohio, to Cincinnati, a distance of 60 miles, and will be equipped with 24 station outfits. The dispatcher will be located at Dayton.

A third circuit will extend from Dayton, Ohio, to Toledo, Ohio, a distance of 140 miles, and 34 stations will be equipped. The dispatcher for this circuit will also be located at Dayton. No. 9 B. & S. copper will be used on all three circuits.

Dispatching Street Cars

The telephone dispatching system is being inaugurated in the street railway company of Augusta, Ga., and in a short time all of the cars will be operated from a general dispatcher's office, and the dispatcher will be able to keep in touch with each car by the reports made from the various reporting stations.

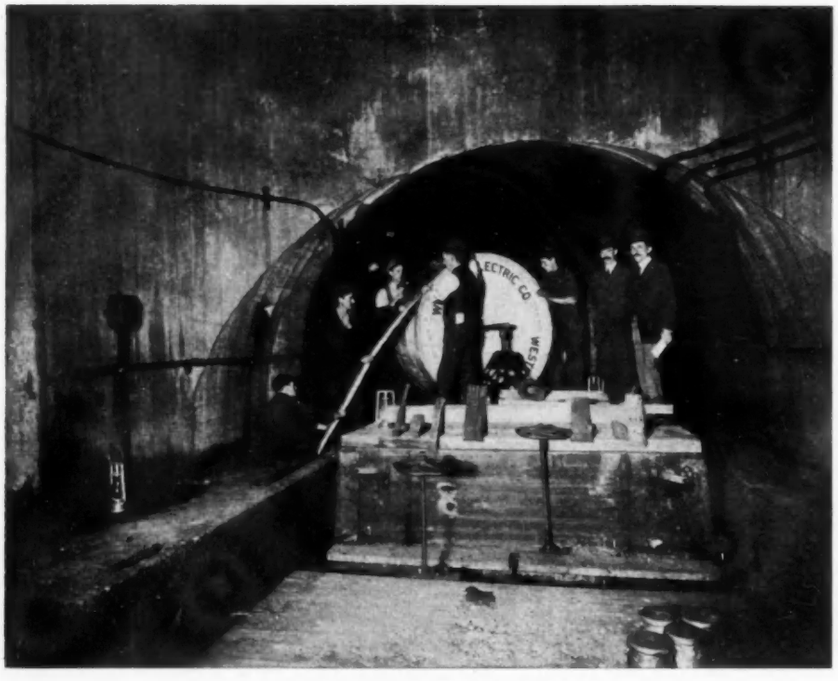
The company believes that it will be able to keep the cars running in the very best of order when the system is installed. At present when a car breaks down on the line, a telephone has to be sought in somebody's house nearby, and this, of course, necessitates much delay.

A Railway Telephone Cable Installation

ON Saturday night, September 16, the plant department of the New York Telephone Company laid 4,000 feet of 300 pair No. 19 gauge standard cable in the subway of one of the Pennsylvania Railroad's tubes under the East River from the foot of East 33rd street, Manhattan, to Long Island City. This cable, furnished by the Western Electric Company, is the last of a group of three, the others laid being a 600 pair No. 22 gauge and a 300 paid No. 19 gauge. Besides providing additional trunks between the two boroughs for growth of business anticipated on account of the reduction of rates which takes place on December 1st of this year, the cables permit the abandoning of a submarine cable crossing located just north of the tubes.

Ten Reels of Cable Loaded on Car.

Before being taken into the tube, the ten reels of cable were unlagged and set up on a specially floored-over gondola car in the order in which they were to be used. Fore and aft of the car containing the reels were two work cars, one for receiving the reels as they were emptied and the other with the necessary ropes and other tackle. A nigger head was placed on the latter car so that the drawing-in rope could be instantly released without waiting for the locomotive to stop, for the cable lengths were accurately measured to fit the subway sections, and if the cable were drawn two feet too far into a manhole, it would be short in the manhole into which it was fed. The pulling-in was done by one of the regular electric locomotives used in the passenger service of the Pennsylvania Railroad, attached to the work car to which the pulling-in rope was clutched. The pull was direct, the locomotive being run at the speed the cable was fed into the ducts. An upright to fit the manholes was specially constructed with adjustable sheaves—one in line with the duct in the manhole and the other extending out of the manhole, the pulling-in rope passing over the two sheaves, thus affording a straight pull out of the duct and also to the work car.

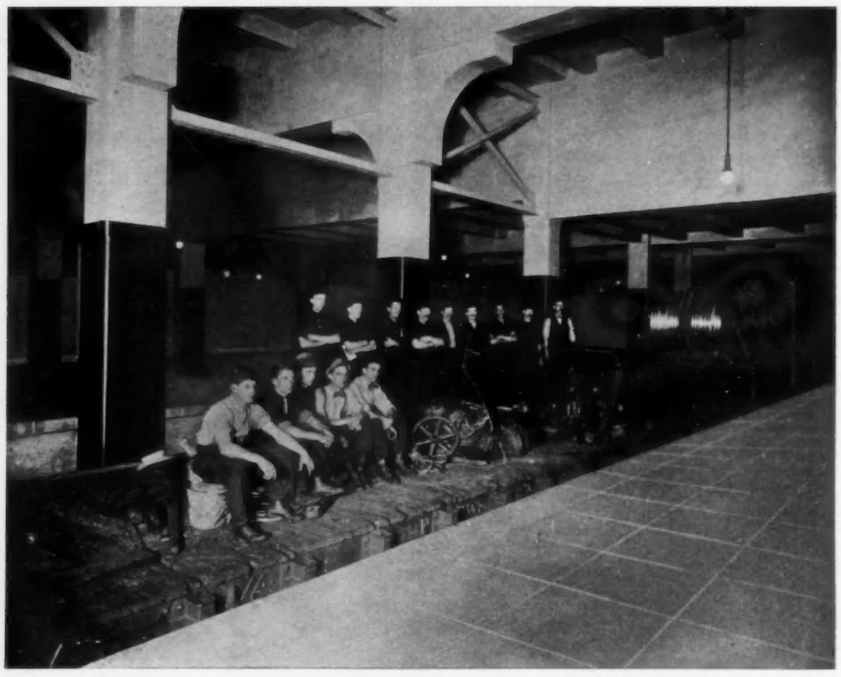


Feeding the Cable Off the Car.

The right of way through tube "C" was granted from 10:30 P. M. Saturday, till 5 A. M. Sunday. The first reel of cable started into the duct at 11:00 P. M. and the last section was in at exactly 10 minutes to three, a total pulling-in time of 3 hours and fifty minutes.

As the locomotive that drew in the cable was also used to shift the car containing the reels the time was remarkably good and reflected the thorough preparation made and the efficiency with which the cable gang worked. The average time for drawing in a section of cable averaging 440 feet, including the shifting of cars, setting up of tackle, drawing in the pulling rope and all other details was twenty-three minutes. The average time of drawing in each section of cable from the time the cable started into the duct was five and a half minutes.

The splicing of the cable will be done while trains are running and during ordinary business hours. Special care will be taken to avoid accident, as the foot walk above the subway is very narrow and the rush of air preceding and following the trains is so strong that heavy tools will not remain on the walk. Everything has to be kept in the manholes or in the grasp of the workman who in turn, if not in the manhole, has to hold on to the hand-rail.



Group of Workmen Engaged in Installing the Cable.

The laying of these cables is something of an event in the local telephone cable field, for heretofore the only means of getting across (or under) the wide waterways of the Hudson and East rivers has been by means of submarine cables. These submarine cables are not an unmitigated joy to those responsible for laying and maintaining them. Although the lead encasing the paper insulated wires is of extra thickness and in turn covered with a soft jute cushion around which are spiraled heavy armor wires, and in the case of many in the East river two sets of armor wires, there is no absolute insurance against interruption to service. The strong tides, especially in the East river where the tide runs like the proverbial water of a mill race, are prone to move the cables constantly, no matter how carefully they are laid or how heavily armored. In many instances cracks are caused in the sheath eventually with the resulting grounding of the conductors. This is not the only source of trouble. Cable crossings are not chosen as anchorages by vessels, for the grappling of heavy telephone submarine cables on anchors is very annoying to the captains of even the largest steamships, as it usually results in the temporary if not permanent loss of the anchor and a waste of valuable time. The submarine cables, however, have been the greatest sufferers when a steam propelled vessel of any size has dropped her anchor in forbidden waters. A few years ago a large German liner, while not under control due to a hawser winding around one of her propellers, dropped her anchor over one of the largest submarine cable crossings of the North river. When the anchor was lifted to the surface both flukes were hanging full of submarine cables. The anchor was temporarily abandoned, as the cables were stronger than the anchor chain.

These submarine cables laid in a regularly constructed subway under the East river insure as uninterrupted service as ordinary trunk or subscriber cables laid in the subway under the streets and avenues of the city.

Baltimore & Ohio Adds Telephone Circuits

The Baltimore and Ohio Railroad has recently placed an order with the Western Electric Company for 85 of its selectors for use on five new circuits. Between Rockwood, Pennsylvania, and Johnstown, Pennsylvania, a distance of 45 miles, there will be two circuits, each equipped with nine stations. One circuit will be used for train dispatching and the other for an intercalling message circuit. The dispatcher for both circuits will be located at Rockwood.

There will also be a train circuit running from Newark, Ohio, to Cambridge, Ohio, a distance of 52 miles. Between these two points another train circuit will be run as an open circuit, and from Cambridge on to Bernwood Junction, Ohio, there will be installed fifteen selector equipments. The total distance of the line will be 105 miles. The dispatcher for both of these circuits will be located at Newark.

In addition, an intercalling message circuit will parallel the train wires running from Newark to Bernwood Junction, a distance of 105 miles. The dispatcher for this circuit will be located at Newark, and 28 stations will be equipped.

The Raritan River Railroad has recently placed an order with the Western Electric Company for telephone selectors and associated telephone equipment to equip their line running from South Amboy, New Jersey, to New Brunswick, New Jersey, with a branch off from Sayreville Junction to Sayreville, and another from Serviss Junction to Lyles. The dispatcher for these circuits will be located at South Amboy.

A Discussion on Railway Telephony

By Members of the A. I. E. E.

LAST June and July TELEPHONE ENGINEER printed a paper on "Developments in Railway Telephony," read by Gregory Brown before the American Institute of Electrical Engineers at Los Angeles, Cal. We present here, as supplementing the paper, a discussion which subsequently took place among the members.

Kempster B. Miller: The matter of railway train dispatching, discussed by Mr. Brown in his paper, is one of great importance, not only to telephone men, but to railway people and the public at large. There is an impressive mileage of railroads, important railroads, that are now being operated by telephone rather than by the telegraph, and this fact is surprising to those who have not watched and been in close touch with the development of this branch of telephony.

An interesting thing in the discussion of the power transmission papers, day before yesterday, was that some companies had seen fit to build a separate pole line for the telephone circuit, distinct from the power transmission line. That is not because it is impossible to put telephone wires on transmission poles and get fairly good service, but in order to effect an extra precaution to insure telephone transmission at the time it is most needed. In many cases that is not done—I should say in the great majority of cases. Now, if the power transmission companies are, for added security, willing to build a separate pole line for telephone circuits when they already have a high grade line, the question naturally arises in my mind in regard to this telephone railway train dispatching, is it wise for the railroads to load up the talking circuit with the selective ringing apparatus? I see no reason for even suggesting the building of another pole line in the case of railway circuits; but it does seem to me that in many cases the building of a separate copper circuit, or iron if the conditions warrant iron, for operating the selective bells would be warranted. This separate circuit for the operation of the selective bells on the dispatching system, would prevent loading down, with ringing apparatus, a circuit already overloaded with a multiplicity of bridged talking circuits. I understand that some railroads are doing it but that many others have refused to spend the necessary amount of money. In view of the extreme importance, particularly from the standpoint of the safety of the public, I think this phase of the subject worth discussion.

L. B. Cramer: One thing that I do not entirely agree with Mr. Brown in is his statement that the "arrangements permitting the signaling of stations without interrupting conversation results in a saving of a considerable amount of time."

So far as my observation has been concerned, that seems to be more of a salesman's talking point than a reality in operation. Perhaps you might be able to talk while the man is signaling, but once he is finished and the man at the other end has an opportunity to say, "What was that?" all of it has to be repeated. Perhaps I have not had enough experience or perhaps our line is not in proper tune to take care of this, but at present that seems to be one thing that does not work out as it is supposed to.

I have also noticed, in regard to the ringing of the bell at the station called, that if the sending keys were made a little larger they would not make a cabinet extremely large and the amount of space would then be enough to produce a ring long enough to call the operator. I notice our dispatcher often calls a second and even a third time. In case of substations, where the bell is mounted on a booth, there being some noise in the machines, we have an auxiliary bell that makes plenty of noise and the substations are the stations from which we get the best responses.

In regard to the switches, which have one position for receiving and one for transmitting, I have already thought of making some changes in the apparatus because in stations where we have a set that is mounted on a desk, about the second or third day after the telephone is in operation the agents get a ruler or a stick and plug the button. This, perhaps, could be made a subject of discipline and taken care of in that way, and you could get the result which you are supposed to get by leaving the button in normal position, and only press the button in when you are talking.

Ralph Bennett: This system was offered to me about two years ago, for use in connection with the transmission line telephone. We did not adopt it. There were a number of questions that came up that the manufacturers could not answer. We have on our telephone line a pressure of about 2,000 volts to the ground, and 600 micro-amperes unbalanced current flow. The line is noisy. When we had trouble on the line we would have additional voltages. The manufacturer could not state how we could repair his sets with the men we had. He could not state definitely his apparatus would satisfactorily select in the presence of those large currents under heavy pressure in this transmission line. I would ask Mr. Brown whether these things could not be handled as the securing of a telephone which will call and select stations for transmission line work is very important.

Ralph W. Pope: It has been my experience in my fifty years of knowledge of the Morse telegraph, that the people who do not understand it and work it don't appreciate what a beautiful and simple method it is of transmitting communications.

The Morse system is available to a man wherever he may be walking around the place. He has not got to go and answer a call and put a telephone up to his ear and drop everything else; but he takes that incidentally with his other work. That is simply one of the features of the Morse system that appeals to the railroad telegraph man. You must remember also that a great many of the men who are in active management are practical Morse operators, have grown up with the system, and know what it can do. This question has been discussed before several conventions of the Railway Telegraph Superintendents, and the probabilities are that I shall have occasion to discuss it at their next convention in June. So you will see that there is an-

other side of the question. Here you have a railroad force developed from telegraph operators who are familiar with a system of this kind, and it is the simplest and best thing that appeals to us in carrying on this work. Were a sounder there, I can receive a message sitting here, and I don't have to hold anything to my ear at all. I simply sit down and write from it, and where a man has grown up with it and is familiar with it, he never can get over that love and appreciation of the simplicity of the Morse telegraph system as known to the one who has practiced it, although it is now thirty years since I have done so.

K. B. Miller: Mr. Pope's remarks suggest a distinct need in railway train dispatching. Some way may be evolved of relieving the despatcher, who is a rather important man, from wearing a harness—I refer to the head telephone. They don't like to do it. The loud speaking receiver has been proposed and tried out rather carefully, and so far as I know has failed. One very ingenious way has been proposed and tried, but has not met with good results owing to poor articulation. It is to use at the despatcher's station a telephone repeater so that the feeble incoming currents could be magnified to produce loud talk in the receiver, and thus relieve the despatcher of the necessity of listening to a receiver held to his ear. This produced plenty of noise but it is articulate speech rather than noise that railway train despatching needs.

J. A. Lighthipe: In the old days of the telephone, when it first started, the best receiver we had was what we called a crown receiver. It had six magnets screwed on the back of a handle, and was found to be wonderfully improved by dropping off five and using one. Then the only carbon buttons that were used in the country—we must give Mr. Edison the credit of being the first man who really used carbon buttons on his transmitter—were made in a small shack in the rear of the laboratory at Menlo Park. Mr. Edison could not use commercial lamp black for making the buttons so he made it by smoking kerosene lamps. He had about fifty of these lamps with a V cut out of the center of the wick to make it smoke, and kept the chimneys turning around until they were full of lampblack which was scraped out later.

The smoking process was attended to by an old Irishman who was possessed of great skill in picking up a lamp when it was on fire and throwing it out of the open door. The old transmitter was made of two brass buttons the faces of which were covered with platinum, and a carbon button pressed in between them. At that time it completely revolutionized the telephone business. It was the first time we could talk any distance at all and it really opened the commercial field for telephone work.

Mr. Edison, at that time, was quite deaf. Today he is even more so. It is very hard to talk to him. He could hardly hear the old Bell telephone; even with the carbon transmitter. It was hard work for him to understand what was said at the other end. He therefore tried to invent, or did invent a loud speaking telephone. Very few of you have ever seen one, although they are very simple to make. They consist of a chalk cylinder made by pressing precipitated chalk and afterward turning it down to one inch in diameter. Upon the surface of the cylinder rested a small stylus tipped with palladium. The end of the stylus was fastened to the center of a mica diaphragm. This cylinder was continually rotating and when the telephone was properly adjusted the sound coming out of the receiver was considerably louder than that going into the transmitter; you almost invariably had to pull your ear away when you were talking into it. I don't know that the principle of that telephone has ever been thoroughly understood. When a current passes through the stylus to the cylinder, the tension is released. In turning the cylinder the diaphragm was continually pulled in one direction. As the different waves passed through the chalk the stylus would slip so that the mica diaphragm in the receiver would practically duplicate the motion of the diaphragm in the transmitter. This telephone lasted only a few months. I don't think it was ever introduced in this country. They tried to put it in use in London, but today it is simply laid aside as one of our curiosities.

When the Blake transmitter came out, it was the starting point of all our telephones. It was adjusted so beautifully that you could stand off five or six inches from the transmitter, whereas before you had to talk right up close. The old Blake transmitter probably has done more good towards the universal adoption of the telephone system than any one thing.

In closing I will simply state that I am very very glad to meet the engineers of the telephone convention here. I have followed up, as far as I could, in my crude way, what wonderful improvements they have made. Mr. McMeen was kind enough to show me the first automatic machine I ever saw. That was at Fourth and Market streets in San Francisco right after the fire. I was simply astonished at the magnificent mechanism of that machine. It was almost human in its hunting up a free trunk, selecting the number, either getting the subscriber or answering back that it was busy. I had no idea up to that time what a wonderful development had been made.

S. J. Lisberger: The telephone system which we have in use in San Francisco is not in any wise connected with a long distance transmission system. The system of the San Francisco Gas & Electric Company is that used by most companies in city distribution work, namely, a main generating station with a number of substations. In San Francisco we have nine substations and one generating station. We were confronted with the problem of quick dispatching between substations in times of trouble. Our ordinary system of telephone communication is a central board in our main office building on Sutter street, from which point lines radiate to stations and substations. There is always an operator at this main switchboard, day and night. It was therefore necessary if an operator at substation B wanted to get into communication with substation C, to get into communication with the main office first. If we lost a bank of transformers, or a small section of line came down, or in the event of serious trouble to a substation, such as we had after the San Francisco fire, there would be so many calls coming into the main board, that the operator could not give time and attention to the substation calls, and very often we found that if one substation could only get into communication with another substation the trouble could be very quickly remedied, whereas we were often delayed five or ten minutes. The solution of the problem was to get quick communication between substations. The system we finally adopted was worked out for us by Mr. McMeen and was an auto-

matic system. We had objections to an intercommunicating system of our own due to the fact that it must be attached to our poles or in our conduits and that was open to the objection that if we had trouble it was entirely possible to lose our entire communicating system. The wire system, belongs entirely to the Home Telephone Company; is carried on their own lines, in their own conduit systems, and is entirely independent of the system we have in operation; all that is necessary for one station to get another is merely to turn the selector switch to the required numbers—it takes three different movements to call; the system starts with 721 and runs to 730. I have shown to several of our visitors the time it takes to call a station, which is about 9 seconds.

It is very often necessary for one station to talk to three stations, or four stations at a time and we have what we call a master switch and one station can get every other station on the line by working that mechanism. Mr. McMeen went further to help us in the problem, (but we did not take his further suggestion, not because we did not want it, but because we could not afford it) wherein he offered to give us a signal board which would show, by means of lights when we were calling a series of stations, whether they answered or not. If station C called stations B, E and F, under our present system, station C would ring first station B, then station E and then station F. All the stations have orders to wait on the line until someone talks. Mr. McMeen designed an indicating board that would quickly indicate who was on the line, would show when B was on the line and next E was on the line and next F was on the line. That was very nice but involved some financial difficulties that we did not care to meet. Otherwise, in all matters, it is most satisfactory to us.

S. G. McMeen: I might say that although Mr. Lisberger spoke of this as automatic, it is not an adaptation of the automatic station equipment. It is an adaptation of the railway dispatching apparatus. The devices used are not telephone exchange selectors, but railway telephone selectors, although instead of working the telegraph key, the operator works it with a round, automatic station dial. This is merely used as an interruptor for the calling impulses.

Gregory Brown: Mr. Miller brought up the question of separate signaling circuits. There is one type of selector, so far as I know, that uses three wires—one for signaling and two for talking. That has not been very extensively used. When you consider the impedance of the selectors across the line, it hardly seems necessary to consider that line very heavily loaded as far as transmission is concerned. For that reason, I do not believe it would be necessary to have a separate signaling wire. Selectors are also being experimented with now that have an impedance of something over 600,000 ohms. These selectors contain advantages due to that high resistance, and if they are used, it certainly would not be necessary from a transmission standpoint to have an extra signaling wire.

Mr. Cramer seems to have had quite a few troubles. The first he mentions is that he does not find it feasible to signal and talk at the same time I have been around pretty nearly all over the country on the various roads, and this is a complaint that is practically new to me. In some cases I have found this to occur, but on investigation we generally find that there is some trouble with the dispatcher's apparatus. One of the troubles that occurs perhaps more than any other and causes these results is the breaking down of the condensers at the dispatcher's office. These would not round off a sending wave to such a great extent.

The length of ring has been criticized—the length of ring at the station. I have gotten around that, where they want a longer ring, by installing a strap key at the dispatcher's office. This key is wired in a parallel with the automatic keys, and if the dispatcher, for any reason wants the bell in the station he is calling to ring longer than would ordinarily be the case, he turns the calling key of that station, and when he hears the answer back he merely presses down the strap key. There are various other modifications of selector arrangements which permit the bell to ring in the substation until the substation operator presses a button. In fact, most any kind of service can be given, according to what the particular railroad wants, but, as a general thing, most of them are satisfied with a certain length ring, about a second and a half, uniformly in all stations.

Another trouble that was experienced was that the agent sticks a toothpick or something in the push button and holds it down. The obvious plan to pursue there is to fire the agent; and this has been done in a great many cases, especially when the telephone was first used on railroads. As has been mentioned by several of the speakers, the operators bucked a good deal at the introduction of the telephone, their idea being that they probably were going to have their salaries reduced, or some of them would lose their jobs. It is not the policy of large railroads to put men out of employment except in very extreme cases, and if the introduction of the telephone permits offices to be closed, or forces to be reduced at certain points the men as a rule are taken care of in some other position.

A test on a 33,000-volt line was mentioned in which the apparatus of two manufacturers was used. It seems to me that the telephone apparatus used in this test is at least very similar among manufacturers, that is, the large manufacturers, and that it hardly could be a question of quality of apparatus to show up in the way that was indicated; that is, according to the statement that was made, I gather that one of them failed completely, and the other one gave good satisfaction. It seems to me there must have been another factor that entered into those two tests that caused that great difference, because the transmitters and coils, and so on, are very nearly similar insofar as their excellence is concerned.

Mr. Bennett spoke of calling and selecting on transmission lines. Mr. McMeen answered this question about the only way it can be answered, I guess, and that is with proper transpositions of your line if you get a quiet telephone line you can do anything with it in the way of talking and selecting.

Mr. Pope brought up the point in favor of the telegraph in that you could hear the telegraph when you were at some distance away from the instrument, whereas in the telephone you have to have the instrument up to your ear. About two months ago I conductd a trial installation down on one of the Pennsylvania lines, using a new type of loud speaking receiver. Criticism has been made of the telephone when used on a railroad division that it was all right for

every purpose except blocking, and that for this purpose it was not as quick as the telegraph, and this criticism seemed to be more or less justified. The reason that this criticism was made was that in telephone blocking it is necessary for the operator to ring up another operator and then go through the motions of putting the receiver on his head and talking with him, whereas with the telegraph he merely ticks off what he wants to say and it is done. And that was the reason for the development or the experiments with loud speakers of various kinds and the attempt to develop a good one.

There has been considerable work done on this, and although it has been comparatively easy to get up a loud speaker for blocking—one that was plenty loud enough—still the articulation was not what it should be. This blocking service represents an ideal condition for loud speakers, because the lines are extremely short and are not loaded, and you can take full advantage of all the energy coming out of the transmitter. This installation was put in in three or four of the towers, and was left in for about ten days. During that time it was used exclusively by the operators for blocking trains, and in fact, they much preferred to use these speakers because the work was easier for them. They were then taken out merely to put them in in a better shape the next time as far as mounting is concerned, making it more convenient for use, and also to employ a busy test by means of a buzzer that had not been taken care of in the first installation. It is intended to use or experiment with this same type of receiver for dispatcher's use, and there will shortly be some trials in that field.

Mr. Elwell spoke of a train dispatching line being in use in Australia in 1902, I think it was. In the first part of my paper I mention two or three instances of the early installation of telephones on a train wire. All these installations used code ringing, and for that reason they were not very successful. There was too much of a load on the dispatcher. I think the first one used in this country was in 1883, which is probably before the one mentioned by Mr. Elwell.

I think there is no doubt that the telephone has proven its case on the railroad and I mention in the paper quite a few advantages of the telephone over the telegraph and I can probably mention quite a few more, and anybody who thinks of the matter can easily see that there is no question but what the telephone does have advantages over the telegraph. Mr. Miller, I believe, raised the point about the distinctness with which the intelligence could be transmitted over the telephone—that is, where train orders, important orders regarding train service in which human life is risked—the distinctness with which they could be heard. Now, in sending out orders, the various railroads have standardized, in their telegraph methods, and they have also adopted practically the same scheme when they shifted over to the telephone. In sending out an order the dispatcher rings the various operators and they will come in and then he states a certain number, 31 or 23, or whatever it is, which indicates the type of order he is to give and he starts to give his order and as he gives his order he writes it down himself so as not to give the order faster than the operator can take it down. As the dispatcher writes the order when he comes to the name of a town, or the time, besides speaking it in the ordinary manner, he spells it out. After he has completed giving the order the operators in their turn repeat this back to him and as each operator repeats it back to him the dispatcher underlines the word repeated, so if there are three operators repeating the record of the order would be in the dispatcher's book—it would have three underlines under each word which was repeated, which would supposedly prove it had been repeated by three operators.

New York Central Using More Telephones

The New York Central Railroad, the first railway in the world to install and put in service selective telephone train dispatching, has recently received from the United States Electric Company of New York 249 selector box outfits which will be used in the extension of its system over twelve circuits. These selectors, as are the others in service on that road, are the Gill bridging telephone selector and are arranged for ringing the signal bell with the main line battery.

The Baltimore & Ohio Railroad, also an extensive user of Gill selective telephone dispatching apparatus, has placed orders for 96 box outfits, equally divided between train wire and message circuit equipment. The message circuit outfit has the intercommunicating features and is equipped for time transmission. The entire order is for the local battery type and in addition an existing circuit of 27 main line bells is to be changed to the local battery type. The auxiliary apparatus in this order includes 29 of the United States Electric Company's new universal intercommunicating calling keys, 110 of the company's new jack type test panels, 69 blocking sets, 30 switching cabinets, and a full equipment of dispatchers' terminal apparatus or signaling sets, keys for switching the dispatcher's telephone from the train to the message wire, and vacuum lightning arresters for protection of the apparatus from high potential currents.

Chicago Great Western to Install Telephones

With the installation of apparatus at Mason City, Iowa, and Austin and Hayfield, Minn., the Chicago Great Western will have complete telephone equipment for the dispatching of its trains on two of its Iowa and Minnesota divisions. This was the announcement of the district superintendent, who is superintending the installation of the instruments and the wiring for the service.

So far as arranged the central telephone stations will be at Mason City, Oelwein, Waverly, Hampton, Clarion, Eagle Grove, Fort Dodge, Carroll, Manning, Harlan, Council Bluffs and Belmond, in Iowa, and Austin and Hayfield, in Minnesota. It is also the plan to equip the cabooses and at least one coach on every passenger train with telephone service.

In line with its policy of continuous progress and improvement, the Florida East Coast will install a telephone system all along its line as an auxiliary in train dispatching.

When the system is fully installed, telephone communication will be had with every station along the line and it will prove an improvement over the present method of relying entirely upon the telegraph service.

Telephone Cable Transmission

By John B. Adams*

THE factors which determine the transmission efficiency or talking value of any circuit are resistance, capacity, inductance and insulation. As applied to a telephone circuit made up of two copper conductors of equal size, insulated with dry paper, twisted together and enclosed in a lead sheath, as a pair of conductors in ordinary telephone cable, it has been found as a result of actual transmission tests and measurements that the inductance and leakage are so small compared with the resistance and capacity, as to be entirely negligible in their effect on the transmission.

The loss of volume in transmission, or attenuation of the current, as it is called, in a telephone cable circuit is, therefore, dependent only upon the resistance and capacity, and the loss may be stated as being proportional to the square root of the product obtained by multiplying the resistance of the loop in ohms by the mutual capacity in farads; i. e. Loss $= K \sqrt{R \times C}$, in which R is the loop resistance, C the mutual capacity and K a constant assumed as equalling the average frequency of the voice currents.

As as an example: In the calculation of transmission losses in cable, suppose it is required to find which of the following cables will give the least transmission loss per mile, and also the length of each cable which will give the same loss or the same volume of transmission.

	Cable No. 1	Cable No. 2
Conductors, gauge B. & S.	19	22
Resistance ohms per mile loop	86	172
Mutual electrostatic capacity	.075	.075

Applying the formula for transmission loss as above stated:

Loss in cable No. 1 $= K \sqrt{86 \times .075} = 2.54\ K.$

Loss in cable No. 2 $= K \sqrt{172 \times .075} = 3.59\ K.$

Therefore, the loss in cable No. 2-22 gauge, is $\frac{3.59}{2.54}$ or 1.41 times as great in cable No. 1—19 gauge, or, with the same capacity, 1.4 miles of No. 19 gauge cable will give the same volume of transmission, i. e., the same talking efficiency, as one mile of No. 22 gauge cable. This result has been confirmed by a large number of transmission tests. With the formula for loss in telephone cable, indirectly stated as being proportional to the simple product of resistance and capacity (the old "K R law"), the loss in the No. 22 gauge cable would be twice that for the No. 19 gauge cable, a result which has been proven to be entirely incorrect by actual test.

In calculating values of telephone transmission, it will be found convenient to adopt some standard for transmission loss, i. e., some unit of loss in terms of which the losses in any circuit can be expressed. In the absence of any accepted name for such a unit, a standard of this description which has been quite generally adopted by telephone engineers in this country is a cable having a resistance of 88 ohms per loop mile (44 ohms per conductor mile), and a mutual electrostatic capacity of .06 microfarads per mile, with no inductance and no leakage. This is known as a standard cable and losses expressed in terms of this unit are referred to as losses in miles of standard No. 19 gauge cable, or simply miles of standard cable.

As an example of the use of this standard in calculating losses, suppose it is required to find the relative talking efficiency of the following circuits:

Gauge	Loop Resistance Per Mile	Mutual Capacity Per Mile
13	21.5	.07
16	42.5	.07
19	85.0	.075

13 gauge $\sqrt{\frac{21.5 \times .07}{88 \times .06}} = .534$ miles standard cable.

16 gauge $\sqrt{\frac{42.5 \times .07}{88 \times .06}} = .75$ miles standard cable.

19 gauge $\sqrt{\frac{85 \times .075}{88 \times .06}} = 1.1$ miles standard cable.

That is, the losses in one mile of the above cables are equivalent to the losses in .534, .75 and 1.1 miles of standard cable.

By a standard grade of transmission is meant the standard of transmission loss, including the loss in switchboard and substation apparatus as well as that in the portion of the circuit between apparatus terminals, commonly called the line, which is considered allowable for any particular class of service. This question of a standard transmission is of increasing importance as toll or long distance lines are extended, and is of the utmost importance that it be carefully considered in the development of new plants or in planning extensions to existing one.

While economical consideration usually governs this question, it should be borne in mind that standards of transmission have been gradually raised by the leading telephone companies throughout the country in meeting the increasing demands for long distance telephone service, who in so doing have found the additional investment necessary a profitable one from the standpoint of service efficiency. A few years ago a circuit having a loss of 40 miles of standard cable was considered a satisfactory one; today, however, a loss of over 30 miles is not considered satisfactory commercially. In general it may be said that a conversation over a telephone circuit under very favorable conditions cannot be carried on where the transmission loss is greater than the equivalent to 45 miles of standard cable.

The question of the proper gauge of wire in a cable for any particular class of service, or the gauge of cables in general to be used in the telephone plant, is dependent upon local conditions: These conditions are: 1. Grade of transmission considered satisfactory. 2. The ratio of the number of trunks to the number of subscribers' circuits entering a central office. 3. The average length of subscribers' and trunk circuits. 4. The ratio of local to toll business origi-

*Abstract of paper read at Boston convention of Association of Railway Telegraph Superintendents.

nating in the district or districts under consideration.

The standard wire gauges in use in cable at the present time are 13, 14, 16, 19, 20 and 22 B. & S., and it is believed that this range of sizes will satisfactorily and economically meet any ordinary requirements which may arise. Sizes outside of this range can, of course, be used, but No. 22 is about as small as is desirable for mechanical reasons, and while conductors larger than No. 13 B. & S. have been used in this country and abroad, with further increase in the transmission efficiency, it is doubtful if the expense of such cable is justifiable except in special cases. In general the classes of service for which the different gauges are used are as follows:

Subscribers' loops	Nos. 22, 20, 19, B. & S.
Local Trunks	No. 19. "
Toll Board Trunks	Nos. 16, 14, 13, "
Toll lines in cables	Nos. 16, 14, 13, 12 and 10.

It is often found economical to use a combination of these conductors in the same cable, as, for instance, 50 pairs of No. 16 gauge with 50 pairs of No. 19 gauge; this is known as composite or combination cable. A cable of this class can be used economically where subscribers and high efficiency trunks are required along the same route, the economy being effected in the saving of lead in the cable sheath.

Dry air is the ideal dielectric between conductors for telephone transmission, but, inasmuch as the conductors in cable could not be kept permanently separated with an all air dielectric, a separator of one or more paper ribbons is applied spirally to each conductor in such a manner as to include as much air around the conductor as possible, and to separate the wires of a pair as much as possible. The spiral application of the ribbon of paper has been found much superior to laying it around the conductor longitudinally, as it secures a greater amount of air space and a more perfect mechanical separation. Pure manila rope paper of a suitable thickness, overlapped in applying sufficiently so that each conductor will remain completely covered under extreme conditions of bending, has been found superior to any other material, both electrically and mechanically.

The two wires of a pair with different colored insulation for identification, are twisted together, the requisite number of pairs cabled or stranded up concentrically in layers, in reverse directions, and the whole wrapped with heavy paper for keeping the core in shape and for additional protection against the grounding of the conductors in the outer layer, to the sheath. The core is then dried or dessicated either in vacuum or drying ovens at a temperature sufficient to vaporize all hygroscopic moisture in the paper, and when perfectly dry the core is immediately covered with a lead pipe, the ends of which are hermetically sealed.

Cable may be made with single, double or triple wrap paper insulation, according to specifications, the triple wrap being principally used in heavy gauge cables. The choice between single wrap and double wrap paper insulation for the ordinary cable in 19, 20 and 22 gauge is a matter of individual preference. There is probably many times as much cable with single wrap insulation in use in this country as with double wrap, and it will continue to be used exclusively by its adherents for ordinary underground and aerial work. On the other hand, the alleged greater immunity from trouble by the use of double reverse wrap insulation, especially in the work of splicing up the cable, is thought by many to be worth all of the slight extra cost over that of single wrap. It might be well to state here that this extra cost is in the lead required for a slightly greater diameter of cable. As the insulation resistance is substantially the same in either case, single or double wrap insulation makes no appreciable difference in the transmission efficiency of the cable.

There are two general methods of determining the electrostatic capacity of cable for telephone service, the difference between the two being the connecting of the wires under test.

1. Grounded test, sometimes called regular test. This is the older method and consists of measuring the capacity between one wire and all other wires, including its mate, grounded to the sheath.

2. Mutual test. This consists of measuring the capacity between one wire and its mate, all the other wires being grounded to sheath.

Considerable argument has arisen concerning the selection of one of the above tests as the proper one to use, and it has even been hinted that some manufacturers, in meeting specifications, have used the mutual test, which gives a lower capacity than the grounded, when it was understood that the grounded test should apply. The grounded test being the older method, it is always understood that it shall apply unless the mutual test is specified, and this is a general rule followed by all reputable manufacturers.

In dry core telephone cable of the usual construction, the mutual capacity will be less than the grounded capacity, and will vary between the limits of 60 to 75 per cent of the grounded capacity, depending upon details incident to the manufacture of the cable. The hard-and-fast rule of mutual = .66 of grounded, as stated by some cable makers, does not hold in practice and cannot be depended on for accurately converting grounded capacity into mutual capacity, or vice versa.

As the ratio of mutual to grounded capacity is not constant, the question of which should be specified to secure a cable of the required transmission efficiency becomes important. In metallic circuit service it is believed that, since the mutual rather than the grounded capacity is the constant of the cable directly indicative of its value as a talking current, the mutual is the proper test to apply, and this is now current practice among many of the larger telephone companies in this country and abroad. As there is a material difference between the results of the two tests applied to the same cable, it is, of course, important that the method of testing be specifically stated in specifications, in order to secure a cable of the desired quality of transmission.

The diameter of a cable for a specified capacity will vary with the expertness of the manufacturer. Improvements in the methods of applying the insulation, etc., have resulted in a smaller diameter for a given capacity, or a lower capacity for a given diameter. Therefore, references to the diameter of cable are omitted from specifications as giving no assurance of the desired capacity or transmission value, the results of actual tests only, being depended on.

In dry core cable the life of the cable as affected by moisture or mechanical damage, is evidently dependent upon the integrity of its protecting lead sheath. The greatest care is therefore exercised to

insure a sheath free from pin holes or other defects. The practice in regard to the thickness and composition of the sheath for telephone cable varies with different purchasers, but as a general guide for Nos. 22, 20 and 19 gauge high capacity cable, recommend minimum thicknesses as follows:

5 to 50 pairs	5-64 inch wall
60 to 100 pairs	5-42 inch wall
120 to 200 pairs	7-64 inch wall
200 up	1-8 inch wall

For low capacity cable an additional 1/64 inch thickness in each case should be used.

I recommend an alloy of lead with a small percentage of tin for all large and soft core cable, and for small cable which may be subject to vibration or swaying by the wind. In large cable especially the addition of a small percentage of the tin in the sheath is a much more economical way of securing additional strength and stiffness than to increase the wall thickness.

Recent Telephone Patents

By David S. Hulfish

988,906. Receiver Case. Louis Steinberger, New York, N. Y. The hard rubber case has soft rubber rings at its large diameter or shoulder and at its smaller end. When laid upon a surface, it rests upon the soft rubber cushion bands.

988,907. Mouthpiece. The perforations at the bottom of the funnel are conical.

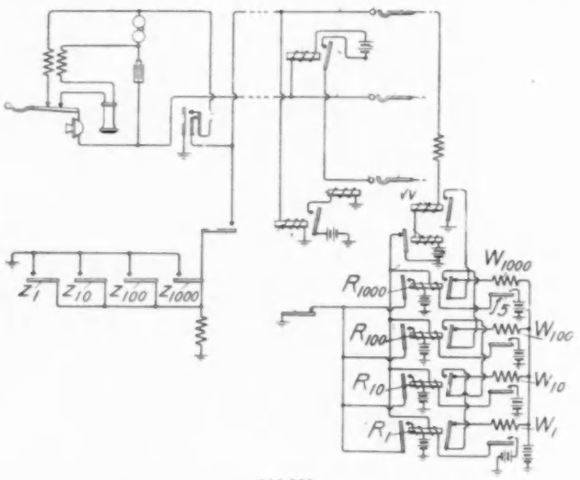
994,371. Selected Lockout Device. William M. Bruce, Jr., Springfield, Ohio, assignor to American Automatic Telephone Company, Rochester, N. Y. A step-by-step selective device for the telephone substation. A vertical rod is raised to a different level for each telephone, and a target shows "Busy" when the line is engaged.

994,500. Selective System. William M. Bruce, Jr., Springfield, Ohio, assignor to American Automatic Telephone Company, Rochester, N. Y. This patent covers Mr. Bruce's system and circuits, for which the patent above covered the subscriber's telephone selector mechanism.

994,719. Telephone System. Henry P. Clausen, Chicago, Ill., assignor to Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. In a switchboard having line lamps with magneto lines, a condenser is included in the line to prevent the actuation of the line relay by direct battery currents.

994,946. Coin Collector. R. R. Mohn and Noah Wine, Polo, Ill. The coin collector box closes predetermined contacts determined by the dimensions of the coin deposited, and electrical signals are given to the central office operator.

995,126. System for Amplifying Feeble Electric Currents. Lee de Forest, New York, N. Y., assignor to DeForest Radio Telephone Company, of same place. The feeble telephone currents are combined with continuous alternating current, an oscillation-

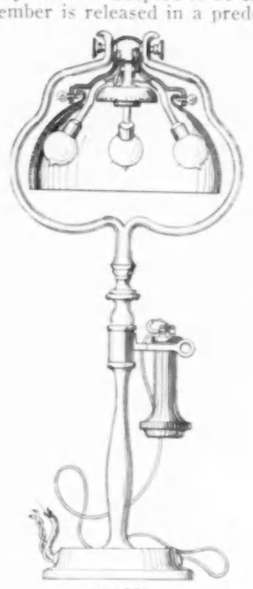


996,550.

responsive device, a circuit tuned to the frequency of the alternating current, and a local circuit including the receiver.

995,294. Substation Selector. Harry O. Rugh, Sandwich, Ill., assignor to Sandwich Electric Company, of same place. A substation telephone selector having a step-by-step element with an arc of teeth, operable rapidly, and a slow-acting circuit changer associated with it.

995,619. Selective Apparatus. Ira F. Manny, Milwaukee, Wis., assignor to Selective Signal Company, of same place. An apparatus for selecting one of a number of stations upon a telephone line, comprising a magnetically operated pawl, a motor-driven member having escapement teeth for the pawl, a signaling member on the rotary member adapted to be engaged by the pawl when the rotary member is released in a predetermined position,



990,770.

the signaling member then giving a signal at the station, thus selected, and means for locking the signalling member in that position.

995,704. Telephone Support. K. B. Miller and William Karsling, Chicago, Ill. A support for holding the desk stand entire. A standard for attachment to wall or desk is connected by an arm to a platform for the telephone, the telephone platform being kept level in all positions of the arm by a rack bar through the arm engaging toothed wheels attached to standard and platform.

995,849. Call Signal. A. J. Dunton, Ketchikan, Alaska. It is well known that if at a local battery station the receiver be held to the transmitter and the secondary winding of the induction coil be shortcircuted a whistle will be produced. Upon the telephones of a private line the receivers are hung thus normally, and when the receiver is removed at one station a relay is charged to close circuits to produce the whistle at the other station of the line.

995,924. Magneto Transmitter System. Jackson B. Stemm, Chicago, Ill., and George E. Slade, Brookfield, Mo. In a telephone system, the transmitter diaphragm has a permanent magnet of horseshoe form atached to it, with the two poles projecting into two coils of wire. When the diaphragm moves in response to sound waves, the magnet poles move in the coils and electric speech currents are produced in the coils. The device is both transmitter and receiver.

996,088, 996,089 and 996,090. Combination Wire and Wireless Systems. Maurice B. Johnson, San Antonio, Texas. The invention relates to a system for telephone exchanges such that persons connected with the office by wire telephones may carry on a telephone conversation over a space not readily traversed by wire transmission. Such a system becomes available when there are two central offices with a barrier, as a river, between them, with a wireless river crossing controllable from either exchange.

996,091. Spark Gap Muffler for Wireless Telephone Systems. Maurice B. Johnson, San Antonio, Texas.

996,092. Cabinet for Carrying Portable Wireless Telephone Set. Maurice B. Johnson, San Antonio, Texas.

996,143. Common Battery Lockout Telephone System. Homer J. Roberts, Evanston, Ill., assignor to Homer Roberts Telephone Company, of same place. The telephone circuits of the stations are controlled by series and differential magnets, in the manner peculiar to the Homer Roberts system. The claims of this patent are specific to the circuits used.

996,391. Telephone Speech Relay. E. F. W. Alexanderson, Schenectady, New York, assignor to General Electric Company. The invention consists in the combination with a telephone circuit of a current reinforcer or relay, comprising an alternating-current dynamo having its field circuit connected to the telephone circuit and its armature circuit tuned approximately to resonance. This is accomplished by connecting the armature in a local closed circuit containing the proper capacity.

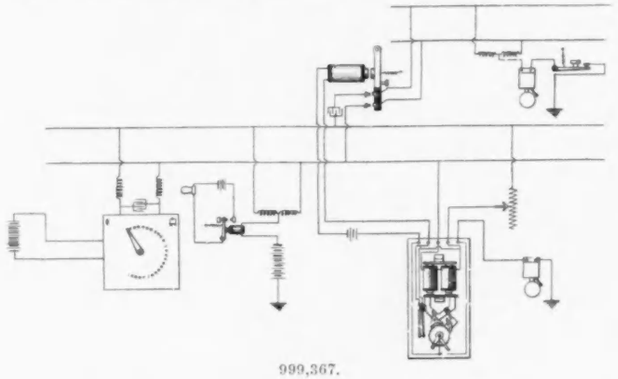
996,445. Telephone Speech Relay. E. F. W. Alexanderson, Schenectady, N. Y., assignor to General Electric Company. The invention comprises the combination with a telephone line extending in both directions, of a high-frequency alternating generator having a winding serving as both field and armature, the winding being common to both portions of the telephone line, and two portions of the winding being in series with respect to the primary circuit and in parallel with respect to the secondary circuit.

996,500. Automatic Telephone Exchange. William H. Matthies, Antwerp, Belgium, assignor to Western Electric Company, New York, N. Y. The selection attained by the central office switches is controlled from the substation calling by suitably changing the resistance of the line circuit.

996,770. Combined Telephone Instrument and Electric Lamp. Frederick J. Kerbel, New York, N. Y. A fanciful combination of two common articles of household furniture. The illustration explains itself, it being noted that the telephone transmitter is located in the top of the dome which contains also the incandescent lamps.

997,012. Telephone Recording Device. Otto Schmid, Heilbronn, Germany. A device similar to an autographic cash register. When the receiver has been removed from the hook, it cannot be replaced until after a register tape has been stepped, the user of the telephone presumably entering data of the message upon the tape before stepping it.

997,042 and 997,043. Cable Terminal. Frank B. Cook, Chicago, Ill. A cable terminal comprising a pair of porcelain halves,



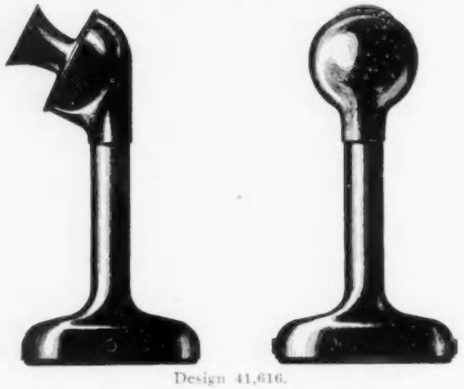
999,367.

carrying terminals, and having a semi-circular base which when completed by the two halves forms a closure for the can cover.

997,250. Time Signal for Telephone Messages. Thomas W. Gardner, Nashville, Tenn., assignor of part to Charles L. Meyers, of same place. A slowly moving disk with a contact member is adapted to close a circuit after a conversation has been sustained for a predetermined time, giving a signal then to the switchboard operator.

997,288. Cord Circuit. Everett D. Hall, New York, N. Y., assignor to Western Electric Company, Chicago, Ill. A cord pair for connecting common battery to magneto lines, with a repeating coil whose inclusion in the circuit becomes automatic.

997,594. Telephone Speech Repeater. Willard Anderson, Longdale, Okla. The induction coils, transmitters and receivers, which form the common combination for metallic circuit work in repeating circuits, are combined here in an ingenious manner to be adapted for repeating on single-wire or grounded lines.



Design 41,616.

997,650. Desk Telephone Support. Andrew Dahlen, Chicago, Ill. An extensible bracket of lazy-tongs type sustains a desk stand at a uniform height. A pivoted link for controlling and sustaining the lazy tongs is the novel feature of the invention.

997,990. Electromechanical Selector. Ernest G. Godfree, Hampton, near Melbourne, Victoria, Australia. This invention has been devised to provide a simple selector for party line systems, intercommunicating systems, and the like, using selection by means of a number of impulses. The device contains a clock spring and gear train, with proper controlling and controlled devices for the required signals. Features of locking out may be embodied in the selecting mechanism if desired.

998,040. Phantom Telephone System. Harry O. Rugh, Sandwich, Ill., assignor to Sandwich Electric Company, of same place. The invention is found in the means for signaling over the phantom. A relay having front and back contacts has a centrally poised armature; when vibrated, the armature permits current to flow in its local circuit, ringing a local signal circuit.

998,043. Telephone Set. Raymond C. Smith, Homer, Mich. The object is to provide an arrangement of circuits whereby the subscriber may listen upon the telephone line without bringing his transmitter into action. The transmitter circuit controlled by a push button which, when pushed, locks by the hook lever until the receiver is hung up.

998,705. Cord Circuit. Ray H. Manson, Elyria, Ohio, assigner to Dean Electric Company, of same place. In the cord pair circuit are two relays for cutting the plug conductors from the circuit. These relays may be operated by the calling subscriber, thereby cutting both subscribers free, without delay for the operator to withdraw the plugs.

998,719. Charles A. Simpson, Chicago, Ill., assignor to Kellogg Switchboard & Supply Company, of same place. The line currents are received from the line relay windings rather than from the cord pair circuits, and the line relay is made locking when attracted by the closure of the telephone bridge.

999,019. Cooling Device for Telephone Transmitter. Carl Emil Egner, Stockholm, and Johan Gunnar Holmstrom, Saltsjo-Storungen, Sweden. The power of a transmitter is limited by the current passing through it, and the current is limited by the heating effect which would burn the carbon were too much current used. A cooling liquid of great resistance is provided, in direct contact with the electrodes.

Design Patent No. 41,616. W. W. Dean, Elyria, Ohio, assignor to Dean Electric Company, of same place. The ornamental design for a desk stand as shown.

999,367. Call System. J. J. Graf, Scranton, Pa. A stepping system for selecting upon party lines.

999,505. Composite System. Oscar M. Leich, Genoa, Ill., assignor to Cracraft, Leich Electric Company, of same place. In a single-wire or grounded circuit, each telegraph relay is bridged by a condenser, and each telephone is bridged by an impedance, all being in series.

Of Interest to the Trade

By A. L. Haase

Foreign Trade Opportunity

A city in the Near East of 250,000 inhabitants desires a telephone system, preferably of the automatic type and with about 200 telephones to start with. A citizen from there now in the United States will furnish detailed information. The suggestion is made that an American concern install the equipment and organize the enterprise as a local company, selling the shares to native capitalists who are ready to purchase the stock. Complete information can be obtained by addressing the Bureau of Manufactures, Washington, referring to No. 6194.

According to information supplied an American consulate by local dealers in telephones for private use and by hardware dealers, there should be a good opening for American telephone instruments for both private and public installation. There is now a discussion relative to the advisability of extending the present system, now using Swedish instruments. This may afford Americans an opportunity to submit bids and receive the contract. The consulate in question would be glad to receive from telephone manufacturers, in addition to catalogues (preferably in Spanish), lowest prices, terms of credit, discounts, etc. Should any telephone manufacturer prefer to correspond direct with an especially interested person in the above line, the name of a resident is given, with whom correspondence may be conducted in Spanish or French. By referring to No. 7440 at the Bureau of Manufacturers, Washington, complete information may be obtained.

Long distance telephone service was inaugurated August 25 between Habana and Guines. The Cuban Telephone Company is now preparing to establish communication with Matanzas and later with Colon and points east.

Western Electric Business

In comparison with most industrials the business of the Western Electric Company is holding up remarkably well. Although four out of the last five months have shown a decrease in gross business, the falling off has been so slight that the increase in the first three months is sufficient to make the whole eight months that have elapsed, show a gain of 3 per cent over the corresponding eight months of 1910.

August was off about 3 per cent as compared with August, 1910. July was also off 3 per cent from last year; June off 4 per cent; May showed a slight gain, and April a falling off of about 4 per cent in comparison with 1910. Business so far has run at the rate of about $66,000,000 for the year, and as there are only four months left it seems more than likely that 1911 will rank as the company's second largest year, even taking into consideration further decreases, which may or may not materialize.

The company experienced a most satisfactory revival in orders billed out of its factories in September. After four months of comparative declines shipments came back last month with the best increase for many a month and the largest this fiscal year. The gain was 12 per cent and September sales were the largest for that month in the company's history.

For the nine months to September 30, Western Electric gross was 4 per cent in excess of the same period last year and a total overturn for the full 12 months of $66,000,000 is promised.

Western Electric will by the first of January be able to occupy some 200,000 square feet of new floor space at its Hawthorne, Chicago, plant. Among other additions this space includes a new general merchandise building.

The gross of the company for the last twelve years totals more than half a billion. In comparison with 1900 the gross sales for 1911 show a gain of 175 per cent, or an average gain of 14 per cent per annum over the 12-year period.

The falling off in business has come chiefly from the eastern section of the country, the south, the middle and far western territories showing improvement as compared with last year.

Abroad the company's business continues to run along steadily with little change. There are still 26,000 on the company's pay rolls, or almost exactly the number in employ a month ago.

A. T. & T. Report

The report of the American Telephone & Telegraph Company for the twelve months ended June 30, 1911, as filed with the Massachusetts Highway Commission, shows gross income of $17,344,680, as compared with $16,503,890 in the corresponding period of the previous year. Operating expenses were $8,004,562, comparing with $8,446,731, and net income was $9,340,118 as compared with $8,057,159. Other income was $24,127,177, comparing with $24,017,390, making a total net income of $33,467,295, which is an increase over the $32,074,547 in the preceding period. Charges were $6,386,314 and left a surplus of $27,080,981, which compares with $26,285,440 and represents 9.83 per cent earned on $275,435,325 stock outstanding, as compared with 10.1 per cent on $259,846,200 stock in the corresponding period last year. Dividend requirements were $21,194,025, as compared with $19,747,337, and left a surplus of $5,886,956, which compares with $6,528,103 last year.

Telephone Use Increasing in Berlin

Telephonic communication throughout Berlin, Germany, has so rapidly increased that the installation of 1907 has proved totally inadequate. The lines then established have been doubled and fresh installations are still being made. It is expected that at the end of the present year Berlin will possess 200,000 telephone connections. There were already 183,545 at the end of June, an increase of 19,059 having been made since January 1.

New Way of Marking Poles

The problem of marking telephone poles has always been a difficult one. The usual method is to paint or stencil them, and so far this is about the only way that has been adopted. But it is not a satisfactory method, nor is it economical when we consider the temporary character of the work. Exposure to the weather soon renders the marks entirely illegible and the work must then be repeated.

According to *New England Telephone Topics*, the New England Telephone Company has conceived the idea of attaching the stencil plate itself to the pole. These plates can be stamped out of aluminum or any sheet metal very cheaply. It costs a little more originally than painting the stencil, but when we consider that after a plate is once attached to a pole it will remain as long as the pole stands, and will require no further attention, we can see that perhaps the cost, after all, is very moderate.

Automatic Telephones in Australia

The Automatic Electric Company of Chicago (trading in Australia as Automatic Telephones [Australasia] Ltd.), has just made a sale to the Australian federal government for installation at Geelong, Victoria, of a complete equipment of an automatic telephone system, consisting of 900 independent lines, 100 lines for private branch exchanges, 100 four-party lines, 1,410 telephones, 1 two-position wire chief's desk, 1 two-position trouble and information desk, and 1 four-position toll board.

The representative of the Automatic Electric Company, now in Sydney, anticipates at an early date that further installations of automatic telephones will be made in other centers of the commonwealth.

Isthmian Telephone Service

A contract has been entered into between the Panama Railroad Company and the Isthmian Telephone Company, a local corporation organized for the purpose of operating telephones on the Isthmus of Panama, by which the railroad company transfers its commercial toll-line business originating at Colon or Panama to the telephone company. The telephone company will at once establish its toll-line service, using the railroad company's circuits out of Panama and Colon. It has an exchange in operation in Colon and has also obtained the concession for the establishment of a local exchange in the city of Panama. The contract does not include the whole Canal Zone in its scope, and the present arrangement of charging $7.50 a month for commercial service will be continued at all intermediate points.

A Telephone That Leaves a Record

The telephone has often been criticized because it leaves no trace of the conversation it transmits. There is no record whatever, so one can never go back and see what the other fellow really said. It is not surprising then, that for some time efforts have been made to devise some apparatus by means of which a permanent record of telephonic conversation can be kept. The phonograph has, of course, been thought of in this connection and, according to *L'Elettricista*, a success has just been scored in this direction. The telephone receiver consists of two loud-speaking telephones. One of these is furnished with the usual mouthpiece, while the other is connected with the vibrating mechanism of a phonograph. The record reproduces the conversation exactly, and can afterward be run off in the usual manner. The current required for this telephone is a little greater than is needed for ordinary installations.

The Crouse-Hinds Company has just issued an attractive booklet describing the "adjustarod," an anchor rod for use with deadman anchors. Different types of the adjustarod are made up of combinations of clamp, pulley, swivel, rod and base-nut. With this device it is possible to regulate the wire tension without loosening the clamp or twisting the wire. The company is also issuing two other new booklets on the subject of headlights.

The Lake Erie, Alliance & Wheeling Railroad has recently placed an order with the Western Electric Company for twenty-two of its selectors, which will be installed on the main line between Phalanx, Ohio, and Dillonville, Ohio. This line is 85 miles in length, and the dispatcher will be located in the middle of the line at Alliance, Ohio.

W. N. Matthews and Brother, St. Louis, are issuing an interesting series of trade circulars. Just now they are sending out No. 3 of the series entitled "Anchoring Under Difficulties," with illustrations. Then there is a Telafault folder, a boltless-guy-clamp folder, a cable specialty booklet, and a card of cable splicing joints.

As the result of an explosion which occurred in the Canadian Collieries Company's coal mine at Bellevue, Alberta, December 9, 1910, in which thirty-one lives were lost, the coroner's jury recommended that telephones be placed in all the workings of coal mines in Canada.

The United States Consular service reports that a system of telephone lines is about to be installed in the Province of Corrientes, Argentine Republic, by which the various departments of the province will be brought into communication with the town of Corrientes, the capitol.

The Chase Motor Truck Company, Syracuse, N. Y., is sending out a folding card calling attention to the number of horses overcome by the heat last summer, and the consequent advantages of the motor wagon. The card is illustrated.

Mathias Klein and Sons, Chicago, announce by circular a new steel tie and splicing wrench, the purpose of which is to tie in the line wire to the insulator. The wrench is a time saver over the customary pliers and makes a clean, solid job.

The plant of the Holtzer-Cabot Electric Company, at Brookline, Mass., was almost totally destroyed by fire on October 7. The loss was $200,000.

Brevities of the Business

PERSONAL NOTES.

Lester J. Lees, for the past six years local manager of the Wisconsin Telephone Company at Juneau, Wisconsin, has resigned his position and has been succeeded by V. M. Deitz, an experienced telephone man of Stoughton, Wis.

C. H. Klouder, for the past few months in charge of the Altoona division of the United Telephone Company, Altoona, Pa., has been promoted to the position of manager of the Scranton division of the company, with headquarters at Scranton. Mr. Klouder has been succeeded at Altoona by H. H. Hodge.

Harry R. Kirkland, vice-president of the American Conduit Manufacturing Company, Pittsburg, Pa., and well known in the electrical field, was married recently to Miss Emily Roberts Houghton, daughter of Dr. and Mrs. Owen E. Houghton, Brooklyn, New York. After a wedding trip of a few weeks, Mr. and Mrs. Kirkland will be at home at the Belfield Dwellings, Pittsburg.

Will Lewis has been appointed local manager of the Pacific States Telegraph and Telephone Company at Truckee, Cal., succeeding William Rapp, resigned.

C. D. Long, for many years wire chief for the Bell Telephone Company at Elwood, Ind., has resigned to accept a position as chief of a large system at Billings, Mont. He will be succeeded at Elwood by Leslie Cain.

William W. Swan, who has been actively engaged with the telephone industry as a patent lawyer, died at his home in Brookline, Mass., October 6. He leaves a widow and one son.

William Geckler, for the past year manager of the Interstate Telephone and Telegraph Company at Springfield, Ill., has resigned and will be succeeded by George Annan, manager of the Sterling and Morrison exchanges for a number of years.

F. X. Cleary, advertising manager for the Western Electric Company, has resigned his position and will engage in special advertising and sales promotion service. Mr. Cleary's long service in the capacity of salesman, sales manager and advertising manager, has given him wide experience and acquaintance in the electrical field which will still continue to be his line of work. He has been succeeded by P. L. Thomas, formerly manager of the Western Electric Company's Pittsburg house.

Hal Dickinson, Minneapolis, Minn., has been appointed manager of the Home Telephone Company, Colorado Springs, Colo.

Wm. C. Getz, of Chicago, has been placed in charge of wireless telegraph construction for the Philippines and recently left for Manila. Mr. Getz was for some time in charge of the signal works at Fort Leavenworth, Kans., but more recently was employed in the offices of Signal Service at Large, Chicago.

W. R. Hunter has been appointed general manager of the Quitman and Adel Telephone Companies, Quitman, Ga.

W. H. Badour, manager of the Twin City Telephone Company, Benton Harbor, Mich., has been appointed assistant plant manager of Southwestern Michigan, with headquarters at Kalamazoo. Upon retiring from the Twin City company Mr. Badour was presented with a Morris chair by the employees of the company.

L. D. Winchell has been appointed manager of the Union Telephone Company's exchange at Breckenridge, Mich.

Sherman R. Hall, vice-president of the Missouri and Kansas Telephone Company, Kansas City, Mo., has resigned his position to go into the stock and bond brokerage business in Portland, Oregon. Upon the completion of the electrical engineering course at Yale in 1895 Mr. Hall entered the employ of the American Telegraph and Telephone Company and has continued in the employ of this company for sixteen years. A year and a half ago he was elected vice-president of the Missouri and Kansas company and during the absence of C. S. Gleed, president of the company for the past few months, he has been acting president of the company.

E. C. Salisbury, who has had charge of the commercial department of the Bell Telephone Company at Beatrice, Nebr., has assumed charge as manager of the Beatrice exchange, succeeding G. L. Rueber, who has been transferred to Tecumseh.

H. C. O'Dell, manager of the Independent Telephone Company at Fairmont, Nebr., has accepted the management of the local telephone exchange at Fayetteville, Ark.

Eugene Bolles, vice-president and general manager of *Advertising and Selling Mazagine*, has disposed of his interest in that publication and resigned his position. Mr. Bolles has been in the publishing business for a number of years and although he announces no definite plans for the future, he will doubtless continue in the field in which he has been so successful.

V. W. Peck, Cardington, O., was recently chosen president of the Morrow County Telephone Company to succeed the late A. A. Whitney.

O. D. Richardson has been appointed manager of the Pacific States Telephone and Telegraph Company at Baker City, Oregon.

R. E. Burkitt has resigned as manager of the New Era Telephone Company, Hebron, Ill., and has been succeeded by George Benedict.

C. S. Winston, chief engineer of the Kellogg Switchboard & Supply Company, and well known in the telephone field, has been elected president of the Alumni Association of the University of Chicago for 1911-1912.

D. W. Wiggs has been appointed manager of the Watseka Home Telephone Company, Watseka, Ill., to succeed H. M. Fiske, resigned.

Chas. A. Matcham, who recently died in Allentown, Pa., was a pioneer in the telephone field, having entered the employ of the Bell Telephone Company in Europe in 1879 and had established exchanges at Antwerp, Brussels, Charleroi, Belgium and Rigi and St. Petersburg in Russia. He came to America in 1881 and had since been engaged in the telephone business in this country.

F. L. Harrington has been appointed manager of the Northwestern Telephone Company's exchange at Albert Lea, Minn. For the past two years Mr. Harrington has been traffic manager for the St. Cloud district of the company, and is succeeded in this position by Max Ricker.

Thomas Burke has been appointed manager of the Bell Telephone Company's exchange at Sharon, Pa., to succeed Harry L. Snyder, who has been retired on a pension, having been in the company's employ since 1886.

A. G. Bean, for the past five years treasurer and general manager of the Dean Electric Company, Elyria, Ohio, has been elected president of that company. He will also continue to discharge the duties of treasurer. Mr. Bean is well known in the telephone field for, aside from his connection with the Dean company, he has been actively interested in the telephone associations, both state and national.

Edward Willard Peck, vice-president of the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., recently died at the age of 66. Not only will his counsel and advice be missed by the company, but by the business of the city in general, as he was widely connected with its activities, being a director of the Rochester Telephone Company, secretary-treasurer of the Co-operative Foundry Company, president of both the Standard and the New York State Sewer Pipe companies, and a trustee and director in the Monroe County Savings Bank and the Lincoln National Bank.

NEW TELEPHONE COMPANIES.

CENTRE, ALA.—The Cherokee County Co-operative Telephone Company, a new corporation capitalized at $30,000, has been organized at this place with W. H. Carter, president and general manager, Dr. S. C. Tatum, vice-president. Among the various purposes of the company is the construction of telephone lines.

REEDLEY, CAL.—Initial steps have been taken looking toward the formation of a co-operative telephone company to take over the local telephone system. Among those interested are T. M. Lane, Carson Reed, Lucas Keyser and E. K. Smith.

ESCONDIDO, CAL.—The Escondido Mutual Telephone Company has been organized and will construct a system at a cost of $50,000.

MARTINEZ, CAL.—The Mt. Diablo Telephone Company has been incorporated with a capital stock of $5,000. The officers of the company are: President, H. C. Wetmore; secretary, Charles Gordon; treasurer, Percy Douglas.

HUNTINGTON, CONN.—The Huntington Telephone Company has been organized with a capital stock of $1,250. The officers of the company are as follows: President, George Rountree; secretary and treasurer, George Waller; directors, James McDonald, S. Cox, H. J. Spriggs and Free Cooper.

ALEXANDRIA, D. C.—Articles of incorporation have been filed for the Richey Telephone Appliance Company with a capital stock of $6,000. It is the purpose of the company to manufacture and

sell telephone appliances. The officers are: President, R. L. Newhouse; vice-president, C. V. Richey; secretary and treasurer, D. A. Baer.

Payette, Idaho.—Articles of incorporation have been filed for the Mutual Telephone Company The capital stock is $100,000 and the officers are as follows: President, A. P. Scritchfield, cashier Payette National Bank; vice-president, O. H. Avey, president, Payette National Bank; treasurer, M. F. Albert, cashier First National Bank; secretary, H. Harland.

Sweet Sage, Idaho.—The Farmers' and Miners' Telephone Company has been incorporated with a capital stock of $100,000. The incorporators are A. L. Gilmore. E. R. Hawley and M. L. Higgins.

Plummer, Idaho.—The Plummer Howe Telephone Company has been incorporated with a capital stock of $10,000 by F. N. McCaslin, R. L. Stout, R. A. Malven and C. J. Mead.

Atlanta, Ill.—The Eminence Mutual Telephone Company has been incorporated. J. M. Goodpasture, James McClellan and M. E. Stroud with a capital stock of $1,000 to operate a telephone system.

Chicago, Ill.—S. H. Couch Company, Inc., of Boston, Mass., has been incorporated to do business in Illinois; capital stock $37,000. Peter F. Hansel, 337 West Madison street, Chicago, incorporator.

Wallace, Ind.—The Wallace Co-operative Telephone Company has been incorporated with a capital stock of $3,000. The directors are Butler Myers, W. E. Spragg, R. L. Hopkins, A. B. Grimes and John Hallett.

Wiota, Ia.—A new telephone company has been incorporated at Wiota to take over the stock of the old company and conduct a system in that place and vicinity. The officers of the company are as follows: President, R. R. Bell; vice-president, T. E. Ostrus; secretary and treasurer, D. R. Love.

Topeka, Kans.—The United Telephone Company is the name of a new organization formed by the merging of the Brown Telephone Company of Abilene, the Concordia Telephone Company of Concordia, the Solomon Valley Company of Beloit, and the Smith and Flint company of Minneapolis. The capital stock of the combined companies is $500,000. The officers of the company are: President, A. T. Rodgers, Beloit; vice-president, G. A. Rogers, Beloit; secretary and treasurer, C. L. Brown, Abilene. The principal place of business will be Abilene. Under the new agreement the United company acquires al lthe Bell toll lines in northern and western Kansas, and arrangement has been made for connection over the entire Bell system.

De Quincey, La.—The De Quincey Telephone Company has been incorporated with a capital stock of $10,000. The officers of the company are: President, J. M. Newhouse; vice-president, J. H. Guidewell; secretary and treasurer, W. R. Watkins; directors, the above officers and Isaac Newhouse, Vernon Newhouse and T. H. Carroll.

Trufant, Mich.—The Trufant and Long Lake Telephone Company has been incorporated with a capital stock of $475.

Lincoln, Nebr.—The Lincoln Telephone and Telegraph Company has been given permission to invest $200,000 in stock of the Fremont, York and Saline county telephone companies. This is to be done in pursuance of an order issued by the commission March 22, authorizing the Lincoln company to issue $488,745 of stock, with the understanding that $200,000 of it was to be used in associated companies, subject to approval by the commission.

Honeoye, N. Y.—The Richmond Telephone Company has been organized with the following officers: President, George W. Patterson; vice-president, John Burton; Secretary, Charles W. Howcroft, Jr.; treasurer, Othello A. Short.

Margaretville, N. Y.—The Mountain Valley Telephone Company has been incorporated with a capital stock of $8,000. The directors of the company are James W. Chisholm, Andrew Cowan, Archibald A. Cowan, John A. Birdrall, New Kensington; Harry Sanford, R. M. Delamater, Howard L. Hewitt and Charles A. Allaben, Margaretville.

Lefor, N. D.—The Deutsche Ungarische Telephone Company has been incorporated with a capital stock of $10,000. The incorporators are Adam A. Lefor, John Lefor, Sr., and John Martin, all of Lefor.

Forman, N. D.—The Forman, Rutland & Havana Telephone Company has been incorporated with a capital stock of $10,000 by John Powersof, Havana, and A. E. Land and H. O. Fardner, of Forman.

Coshocton, O.—The Coshocton Telephone Company has been incorporated with a capital stock of $150,000. The incorporators are P. Yenson, general manager of the Cleveland Telephone Company; W. S. Crates, C. C. Fahl, Rollo R. Stephens and W. Newton.

Rockport, O.—The Citizens' Telephone Company has been incorporated with a capital stock of $5,000. The incorporators are O. C. Stephens, of Slate; A. J. Bowersock, Charles Ludwig, C. W. Clegg, J. H. Stephens, of Rockport, and S. A. Williams, of Mineral Wells.

Franklin, O.—The Home Telephone Company has been incorporated with a capital stock of $2,000 by J. L. Dodson, A. H. Washick and W. C. Pearson.

Keota, Okla.—The Keota Telephone Company has been incorporated with a capital stock of $5,000 by R. N. Robinson, R. A. Bonham, H. D. Price, Jr., all of Keota.

Red Oak, Okla.—Articles of incorporation have been filed for the Limestone Rural Telephone Company with a capital stock of $2,500. The incorporators are F. O. Brown, Lincoln Postock, Red Fork; J. F. Russell, W. C. Best, Fisher, Okla.

Dalles, Ore.—The Bentley Telephone Company has filed articles of incorporation with the county clerk for the purpose of operating lines in Polk, Yamhill, Lincoln and Tillamock counties. The incorporators are A. O. Scarff, William F. Schadd and D. S. Bentley.

Elgin, Ore.—At a mass meeting of the citizens of Elgin and the Farmers' Union of Union county, a new co-operative telephone company, was organized to operate throughout the county. The officers are as follows: President, William Parks; vice-president, Leo Stoop; secretary, Jesse Crum; directors, J. Masterson, L. L. Cross, F. Graham, Harry McNab, E. Rinehart, Thomas Fleming and R. Roulet.

Hermiston, Ore.—The Hermiston Telephone & Electric Company has been organized for the purpose of installing and operating a telephone system in this place and vicinity.

Prittsville, Pa.—The Fayette Rural Telephone Company has been incorporated with a capital stock of $5,000 by John D. Truxel, J. C. Milligan, D. Wright and C. L. Truxel, Connellsville R. F. D.; William Hay, E. McC. Overholt, Abram Truxel, A. A. Wingrove, J. W. Overholt, Scottdale R. F. D., and Albert W. Truxell and W. R. Bungard, Mt. Pleasant R. F. D. The principal place of business is Prittsville.

North Wales, Pa.—The Kulpsville Rural Telephone Company has been organized with Horace D. Frederick as president and Howard Y. Ruth, treasurer.

Greensburg, Pa.—The Yukon-Waltz Telephone Company has been incorporated with a capital stock of $5,000. The directors are as follows: F. C. Baughman, Waltz Station; C. F. Hunker, Yukon; H. B. Emerson, Yukon.

Fort Stockton, Tex.—The Pecos & Rio Grande Telephone Company has been incorporated with a capital stock of $120,000. The incorporators are James Rooney, Mart Adams and Frank Rooney. The new concern has absorbed the Alpine Telephone Company and the Fort Stockton Telephone Company, and it is the purpose to operate a telephone system in Brewster, Pecos, Terrell, Presidio, Jeff Davis, Reeves, Ward and other counties in western Texas.

Farmington, Utah.—The Davis and Weber Counties Power and Telephone Company was recently organized in this place to take over the defunct Independent Telephone Company and the Davis County Power Company. About $90,000 worth of stock was issued by the two old companies. This will be taken over by the new concern, the stockholders in the absorbed companies being given an equal amount of stock in the Davis and Weber Counties Power and Telephone Company. Preferred stock to the amount of $50,000, drawing interest at 8 per cent, will be issued, the proceeds being to start the new company in business. The directors of the company are as follows: A. Marian, George Parker and N. Bydee, of Weber county; S. M. Smith, of Layton; N. T. Porter, of Centerville; Robert Blamire, Kaysville; Stern Hatch, South Bountiful; Amos Cook and J. A. Eldridge, Bountiful.

Letart, W. Va.—The Big Four Telephone Company has been incorporated to construct and operate telephone lines. The capital stock is $4,980 and the incorporators are George T. Adkins, Emery F. Fry, C. S. Murr, of Letart, and George Somerville, of Maggie.

Kingston, Wis.—Articles of incorporation have been filed for the Grand River Telephone Company with a capital stock of $5,000. The incorporators are H. A. Price, Scott Paterick and Emil Stroschien.

RATES.

Hartselle, Ala.—The Southern Bell Telephone and Telegraph Company has notified its patrons that the rates would be doubled on all telephones in the near future.

Mt. Vernon, Ind.—An agreement has been reached by the city council and the Cumberland Telephone Company. The fran-

chise calls for a rate of $1.65 for straight residence, $1.50 for party lines, $2.75 straight business and $2 party lines. All poles are to be taken off the main streets of the city and placed in alleys. The company will pay a bonus of $3,000 to reimburse the city for the amount spent in litigation.

DYERSVILLE, IA.—The Inter-State Telephone Company has notified its patrons that its rates have been increased from $14 to $18 per year.

SPRINGFIELD, MO.—In accordance with the terms of a franchise just granted to the Ozark Bell Telephone Company in Springfield, the rate on business telephones is cut from $42 per year to $36 and from $24 to $22 on independent residence service. Other concessions of the company for the 11-year franchise granted were the payment of $11,000 annually to the city, a bond of $25,000 that $200,000 would be spent in a year in new buildings, removal of poles and wires from the main business sections and the payment of all costs and attorneys' fees in the six years' litigation which has preceded the compromise.

TIFFIN, O.—The city council has passed an ordinance fixing the telephone rates in this city at $1.00 per month for residence telephones and $3.00 the maximum rate for business telephones. The Tiffin Consolidated Telephone Company, a merger of the Bell and Home companies, will appeal to the State Public Utilities Commission.

PORT CLINTON, O.—The Ottawa County Home Telephone Company has increased its rate for residence telephones from $1.00 to $1.25 for private lines. Party lines will be continued at $1.00 a month.

SEATTLE, WASH.—The State Public Service Commission recently granted the Independent Telephone Company permission to increase its rates on one-party business telephones from $4 per month to $5; two-party business telephones from $3.50 to $4; one-party residence from $2.50 to $2.75; two-party residence from $2 to $2.25. This order was based upon the finding that the present rates failed by about $56,000 per annum to provide sufficient revenue for the company.

AMHERST, OHIO—The Amherst Telephone Company has decided to increase the rates for business telephones fifty cents and for resident telephones fifty-five cents.

FRANCHISES ASKED AND GRANTED.

BOONVILLE, IND.—The city council has appointed the following committee to confer with the Cumberland Telephone Company for the purpose of drafting a franchise to do business in this place: Mayor T. D. Scales, City Attorney Will Hatfield, Julius Bohrer, Henru Baurer and J. E. Madden. The company has been operating under a franchise which was granted by the city to the American Bell Telephone Company and now that this action is brought by the council the franchise is rendered void.

FAIRBURY, ILL.—The Fairbury Telephone Company has petitioned for a new franchise increasing the rates from $1.00 to $1.25 per month and promising better service.

SUSANVILLE, CAL.—The Johnstonville Telephone Company has been granted a five-year franchise in this place.

EVANSVILLE, IND.—The Evansville Independent Telephone Company has asked for a twenty-five-year franchise in this city.

CORBIN, KY.—The city council has sold a franchise for the construction of a new telephone system in the city of Corbin to the Corbin Home Telephone Company, the work to be completed within six months. It is further stipulated that the rate shall not exceed $2.50 for business houses and $1.50 for residences.

FRANKLIN, KY.—After a long effort the Farmers' Telephone Exchange has secured the franchise in this place formerly held by J. T. Lovell.

WABASHA, MINN.—The Greenfield Farmers' Telephone Company has been granted a franchise to install a complete system in this place.

JONESBORO, MISS.—The Rural Telephone Company of Jonesboro has secured a franchise from the city of Laurel to lay lines underground and connect the business houses with the country subscribers.

ECHO, ORE.—The city council has granted a telephone franchise to C. P. Bowman. Application has also been made to the city council of Stanfield.

MEADVILE, PA.—The Meadville Telephone Company has been granted a franchise to install a telephone system in Venango.

VALE, ORE.—The city council has granted the Independent Telephone Company permission to enter this city.

CHEYENNE, WYO.—The Mountain States Telegraph and Telephone Company has been granted a ten-year franchise in this city. Under the terms of the new franchise the four-party lines will be abolished and single and two-party lines only will be used.

DUPREE, S. D.—F. E. Sexton, of Timber Lake, has been granted a franchise to install a telephone line in this county.

MARLIN, TEX.—A franchise has been granted to J. B. Earle, of Waco, by the city council, whereby he and his associates are permitted to use the streets for purposes of an independent telephone system.

ROCKHILL, S. C.—The Rock Hill Telephone Company has been granted a twenty-five-year franchise by the city council.

SUFFOLK, VA.—The Franklin town council has apointed a committee composed of John C. Parker and E. L. Beale to confer with James H. Corbitt, attorney for the Southern Bell Telephone Company with a view to drafting a franchise for local and long distance telephone service.

FINANCIAL ITEMS.

CHICAGO, ILL.—The Canadian Bell Telephone Company will increase its capital stock from $12,000,000 to $15,000,000.

MEADE, KANS.—The Southwestern Telephone Company has been granted permission by the Public Utilities Commission to issue $20,000 in bonds for improvements.

HOMER, MICH.—The Homer Telephone Company has increased its capital stock from $35,000 to $75,000.

MONROE CITY, MO.—At the annual meeting of the Farmers' and Merchants' Telephone Company it was voted to increase the capital stock from $6,000 to $10,000, also to extend a metallic circuit to Hannibal. The following directors were elected: A. Lee Ely, James Smith, William Hamilton, W. H. Elliott, Jno. Kendrick, I. L. Owens, W. J. Rouse, and Jno. Yates.

GLENBURN, N. D.—The Lone Star Rural Telephone Company has increased its capital stock from $10,000 to $50,000, for the purpose of extending its system into the adjoining country.

SALTILLO, PA.—The Saltillo Telephone Company, operating in Huntingdon county, has increased its stock from $2,500 to $25,000.

MISCELLANOUS.

OSCEOLA, ARK.—The Tri-State Telegraph and Telephone Company's lines in the Northeastern part of the state have been purchased by the Southwestern Telegraph and Telephone Company. The property consists of exchanges at Osceola, Blytheville, Manila, Wilson and Luxora and toll lines connecting with all points in that part of the state. By this purchase between 1,200 and 1,500 names are added to the list of subscribers to the Southwestern Company. Extensive improvements will be made by the new owners. The Southwestern Company has also taken over the property of the North Arkansas Telephone Company, including nine of the best local exchanges in the state and representing not less than 3,000 subscribers.

JONESBORO, ARK.—The Home Telephone Company has been purchased by the Southwestern Telephone Company for a consideration of $50,000. The company will erect a new exchange building in this city.

NEWPORT, ARK.—Dissatisfied with the service of the Southwestern Telegraph and Telephone Company the citizens of this place have circulated a petition subscribing for stock in a new telephone company and more than $65,000 has been pledged.

SANTA ROSA, CAL.—The Clear Lake Telegraph and Telephone Company and the Sonoma Valey Light and Power Company, have merged the light, power and telephone business into one.

LOS ANGELES, CAL.—The Pacific Telephone and Telegraph Company will erect a new exchange building at the corner of Vernon and Denker avenues at an approximate cost of $45,000. In addition the company is planning to install additional conduits, cable and outside wiring, making a total expenditure of approximately $200,500. The company will also erect a new building, Mission style, at Bakersfield, at a cost of $80,000.

LOS ANGELES, CAL.—As a test of physical connection between the two telephone companies in this city the Board of Public Utilities has asked permission to install five trunk lines of each leading to a central exchange in the municipal buliding and allowing intercommunication of subscribers at a nominal toll, the experiment to be continued for one year at an estimated cost to the city of about $5,000.

CHILLICOTHE, ILL.—A deal has been consummated whereby the People's Telephone Company will be taken over by E. S. Sterrett and C. A. Camp of Henry, Ill., and C. B. Cheadle of Joliet. It is the intention of the new owners to completely overhaul the system which will include the placing of the wires

underground and the erection of a substantial building which will be supplied with modern, up-to-date office equipment.

Petaluma, Cal.—W. D. Thomas of this place has been awarded a contract by the Guglielmetti Rural Telephone Company for the extension of its lines into Cotati.

Delmar, Del.—The Riverton and Delmar Telephone Company has been purchased by the Diamond State Telephone Company for $5,000.

Decatur, Ill.—The name of the Douglas County Telephone Company has been changed to the Douglas Telephone Company.

Marion, Ind.—Manager Ed Knipple of the United Telephone Company announces that his company will make many improvements in its service in this city.

Crawfordsville, Ind.—The stockholders of the Home Telephone Company have re-elected the following officers for the coming year: President, H. H. Ristine; vice-president, D. M. Peck; general manager, C. D. Swisher; secretary and treasurer, J. D. Wedding; directors, the above officers and T. H. Ristine, G. F. Kenaston, C. W. Hymer and James S. Brailey, Jr.

New London, Ia.—At the annual meeting of the Henry County Telephone Company the following officers were elected: President, W. J. Francy; vice-president, J. E. Paterson; secretary, J. B. Woodside; treasurer, W. H. Bangs.

Ness City, Kans.—The telephone exchange at this place has been purchased by B. I. Wells, who will conduct the same.

Buckner, Kans.—The Jackson County Telephone Exchange, operating in Buckner and vicinity, has been purchased by Fred Kitchner.

Topeka, Kans.—The Public Utilities Commission has made an order permitting the consolidation of the Stafford, Great Bend and Larned telephone companies with the Arkansas Valley Telephone Company, being the first consolidation under the law permitting the commission to supervise the deal. The valuation of the four properties merged was fixed at two hundred thousand dollars and this is the limit of the capital stock which the Arkansas Valley Company may issue. The commission gave the Arkansas Valley Company permission to issue one hundred thousand dollars additional capital later to carry on additional extension and improvement work already contemplated.

Mt. Hope, Kans.—The local telephone exchange, owned by T. H. Cornwall, has been purchased by the Missouri and Kansas Telephone Company.

Baltimore, Md.—The Public Service Commission has granted the Highland Telephone Company of Hartford County permission to sell its property in Pennsylvania to the Delta Telephone Company for $30,000.

Bronson, Mich.—At the annual meeting of the Bronson Mutual Telephone company the following officers were elected: President, A. G. Bushnell; vice-president, Frank Martin; treasurer, Dr. P. H. Gunsallus; secretary, L. C. Walker, directors, the above officers and John Shaffmaster, Frank Coward, Delbert Williams, Clifton Short, Peter Cook, Dr. H. P. Mowry and Burnley Foote.

Alpena, Mich.—M. L. Streeter of Lansing, has purchased the controlling interest in the Alpena Mutual Telephone Company. The system will be rebuilt.

Saginaw, Mich.—H. R. Hudson, district manager of the Michigan State Telephone Company announces that his company will expend $30,000 in improving the local system.

Port Huron, Mich.—The Michigan State Telephone Company will expend $10,000 in improving its system in this city.

Guymas, Mex.—The Sonora Telephone Company is asking bids for the construction of a telephone line from Guymas to Hermosillo. The estimated cost is about $75,000.

Rochester, Minn.—The local telephone company plans the installation of a new switchboard and other improvements at a contemplated expenditure of $12,000 to $20,000.

Duluth, Minn.—The Zenith Telephone Company plans many additional improvements in its system during the next season. Proceeds of the $250,000 bond issue, recently arranged for, will be applied towards the erection of a central exchange on Second street west, and for improvements in both the eastern and western sections of the city.

Springfield, Mo.—The Ozark Bell Telephone Company will erect a long distance copper circuit line from Springfield to Memphis at a cost of $100,000.

Mexico, Mo.—The local plant of the Mexico Telephone Company was recently purchased by the Missouri and Kansas Telephone Company.

Bismarck, N. D.—At the recent annual convention of the North Dakota Independent Telephone Association the following officers were elected for the following year: President, C. H. Coar, Minot; vice-president, I. D. Richardson, Fargo; secretary-treasurer, A. C. Lane, Kensal.

McClusky, N. D.—The McClusky Telephone system has been purchased by E. W. Taylor and Sons of Crookston, Minn., who will conduct the same.

Amherst, Ohio.—At a recent meeting of the Amherst Telephone Company the following officers were elected: President, A. V. Hageman; secretary, B. G. Nichols; treasurer, H. E. Hageman. It was also voted to spend a large amount to reconstruct the entire system and to rebuild the local plant, making it one of the best in the county.

Woodburn, Oregon.—The Northwestern Long Distance Telephone Company has closed a deal whereby it takes over the local telephone system owned and operated by Henry Chappelle. William H. Waterbury, who owns a controlling interest in the United Telephone Company of this city, has also transferred his interest to the Northwestern company, which also recently purchased the Granger Telephone Company at Kelso, Wash.

Sioux Falls, S. D.—The Northwestern Telephone Company expects to expend $175,000 on its new building and in placing a large section of its wires underground.

Chamberlin, S. D.—A deal has been closed whereby the Interior Telephone Company which operates in this place and vicinity, has been taken over by the Nebraska Telephone Company.

Burnet, Tex.—At a meeting of the Rural Telephone System R. T. Howell was elected president, F. W. King, secretary, and Ed Shuford, Roy Fry, F. W. King and R. T. Howell, directors.

Hearne, Tex.—The Hearne Telephone Company has been purchased by the Southwestern Telephone and Telegraph Company for a consideration of $16,500.

Salt Lake City, Utah.—The Mountain States Telephone and Telegraph Company has secured permission to begin work on the construction of its Hyland substation, a three-story, reinforced concrete, fireproof building to cost $30,000.

Suffolk, Va.—The Atlantic Coast Telephone Company has been taken over by the Southern Bell Telephone Company.

Milwaukee, Wis.—A municipal telephone system for all departments of the city, connecting fire and police stations, bridges and viaducts, natatoria, schools, flushing tunnels and pumping stations, will be installed according to plans prepared by Capt. Oscar Kleinsteuber of the newly consolidated police and fire alarm systems.

Deerfield, Wis.—The majority of the stock of the Deerfield Telephone Company has been purchased by Clarence S. Jordalen.

Cheyenne, Wyo.—The Mountain States Telephone and Telegraph Company contemplates the expenditure of $50,000 in improving its system in this city which will include a new switchboard and additional cable.

Spokane, Wash.—The Interstate Telephone Company of this city has purchased the Newport Telephone Company of Newport. The value of the plant is between $20,000 and $25,000.

Auburn, N. Y.—The Auburn Telephone Company and the Skaneateles Telephone Company have been purchased by the Friendship Telephone Company, a holding company of the Bell interests. Outstanding securities of the two companies involved are something over $400,000, and payment to the holders is said to be about $175,000.

Appleton, Wis.—At the annual meeting of the stockholders of the Fox River Telephone and Telegraph Company the following officers were elected: President and general manager, Capt. J. M. Baer; vice-president, W. F. Hayes, Chicago; secretary, William Van Nortwick; treasurer, D. E. Reese.

St. Cloud, Minn.—The Northwestern Telephone Exchange Company has secured a site for the construction of an exchange

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Marriage by telephone is one of the up-to-date stunts of the Pennsylvania oil region. The Oil City *Derrick* says that Alderman Henry McCready, of that city, established a new record in speedy matrimony recently. At 4 o'clock in the afternoon Joseph Donley and Mrs. Alice Hogue called at his office and announced their intention of being married. They had not secured a marriage license. The squire made out the papers, telephoned to Recorder H. G. Johnson, at Franklin, that he had filled them out and received permission to go ahead with the further requirements. The couple faced the squire and were made one in jig time.